PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-353515
(43)Date of publication of application : 06.12.2002

(51)Int.CI. H01L 33/00

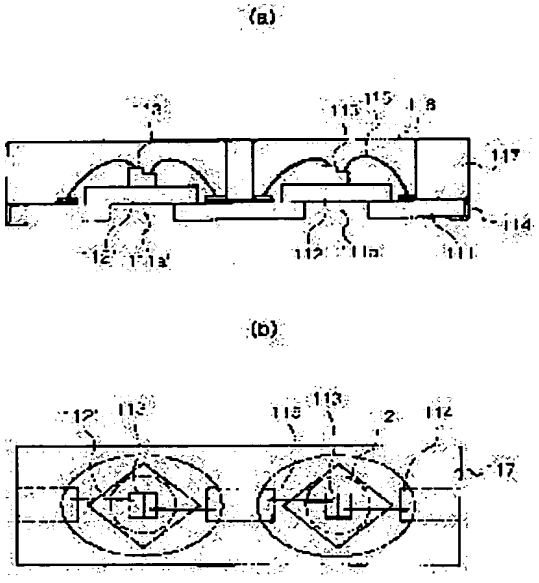
(21)Application number : 2001-321283
(22)Date of filing : 19.10.2001

(71)Applicant : SAMSUNG ELECTRO MECH CO LTD
(72)Inventor : SONG KYUNG-SUB
PARK YOUNG-HO
LEE CHANG-YONG

(30)Priority
Priority number : 2001 200128685 Priority date : 24.05.2001 Priority country : KR

(54) LIGHT-EMITTING DIODE, LIGHT-EMITTING DEVICE USING THE SAME, AND MANUFACTURING METHOD THEREFOR

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a light-emitting diode(LED), a light-emitting device which uses it, and its manufacturing method.
SOLUTION: This light-emitting device is manufactured with various heat radiation designs. On a ceramic substrate 111, where many heat radiation holes (holes for heat sink) 11 are bored, a pattern electrode of a specific style is provided first. Auxiliary ceramic sheets 112 and 112' are laminated on the ceramic substrate, to cover the respective heat radiation holes and an upper ceramic sheet 117 is laminated so that the part of the pattern electrode and the whole or part of the auxiliary ceramic sheet are exposed. On the auxiliary ceramic sheet, LED elements 113 and 113' are mounted. Respective electrodes 114 and the LED elements are electrically connected with wires 116, and the LED elements in the upper ceramic sheet are sealed with insulation resin. The light-emitting device thus manufactured is very suitable for a large-area display and for next-generation lighting facilities, since its heat radiation characteristics are improved and the LED elements can be mounted on a large-area substrate with high density.



LEGAL STATUS

[Date of request for examination] 19.10.2001
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number] 3469890

Searching PAJ

[Date of registration] 05.09.2003

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The ceramic substrate which prepares one heat dissipation hole (a hole for heat sink), Said heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, The electrode which forms a fixed pattern centering on said heat dissipation hole on said auxiliary ceramic sheet, The LED component which is electrically connected by said electrode and wire and is mounted on said auxiliary ceramic sheet, Light emitting diode characterized by having the up ceramic sheet by which a laminating is carried out on an auxiliary ceramic sheet while surrounding said LED component, and the insulating layer which seals the LED component in said up ceramic sheet.
[Claim 2] Light emitting diode according to claim 1 characterized by applying a metal paste along with the contact part of said auxiliary ceramic sheet and ceramic substrate inside said heat dissipation hole.
[Claim 3] Light emitting diode according to claim 1 characterized by filling up with a metal paste inside said heat dissipation hole.
[Claim 4] Light emitting diode according to claim 3 characterized by the lower part of the metal paste with which it fills up inside said heat dissipation hole adhering to a metal plate along with said ceramic substrate.
[Claim 5] Light emitting diode according to claim 3 characterized by filling up with a metal paste inside said heat dissipation hole, and applying a metal paste to the lower part of said ceramic substrate.
[Claim 6] Light emitting diode according to claim 1 characterized by inserting a regulus (lump or slug) inside said heat dissipation hole.
[Claim 7] Said ceramic substrate and an auxiliary ceramic sheet, the ceramic substrate concerned, or an auxiliary ceramic sheet is light emitting diode according to claim 1 characterized by being an alumina or SiC.
[Claim 8] Said electrode is light emitting diode according to claim 1 characterized by consisting of a ceramic substrate side in Ag, nickel, and Au layer.
[Claim 9] Said insulating layer is light emitting diode according to claim 1 characterized by being epoxy or Si system transparency resin.
[Claim 10] Said auxiliary ceramic sheet is light emitting diode according to claim 1 characterized by establishing one heat dissipation hole in the lower part of an LED component further.
[Claim 11] A phase equipped with the ceramic substrate which prepares one heat dissipation hole, and the phase which carries out the laminating of the auxiliary ceramic sheet on said ceramic substrate, The phase of preparing the pattern electrode of a fixed gestalt centering on said heat dissipation hole on said auxiliary ceramic sheet at both sides, The phase which carries out the laminating of the up ceramic sheet which prepares opening (opening) of a predetermined configuration so that said some of pattern electrodes may be exposed on said ceramic substrate, The phase which carries out coincidence baking (co-fire) of said ceramic substrate by which a laminating is carried out, The phase of mounting an LED component on an auxiliary ceramic sheet in the location which counters with a heat dissipation hole after preparing an electrode on the pattern electrode of said auxiliary ceramic substrate, The manufacture approach of the light emitting diode characterized by having the phase which seals the LED component in said up ceramic sheet by insulating resin after connecting an LED component to said electrode electrically respectively.

[Claim 12] Said ceramic substrate and an auxiliary ceramic sheet, the ceramic substrate concerned, or an auxiliary ceramic sheet is the manufacture approach of the light emitting diode according to claim 11 characterized by using an alumina or SiC.
[Claim 13] Said electrode is the manufacture approach of the light emitting diode according to claim 11 characterized by galvanizing nickel and Au layer in Ag paste layer on a ceramic substrate, and growing into it.
[Claim 14] Said insulating resin is the manufacture approach of the light emitting diode according to claim 11 characterized by being filled up using epoxy or Si system transparency resin.
[Claim 15] Said ceramic substrate by which a laminating is carried out is the manufacture approach of the light emitting diode according to claim 11 characterized by carrying out coincidence baking at 800-1050 degrees C.
[Claim 16] The manufacture approach of the light emitting diode according to claim 11 characterized by applying a metal paste along with the contact part of said auxiliary ceramic sheet and ceramic substrate inside said heat dissipation hole.
[Claim 17] The manufacture approach of the light emitting diode according to claim 11 characterized by being filled up with a metal paste inside said heat dissipation hole.
[Claim 18] The manufacture approach of the light emitting diode according to claim 17 characterized by being filled up with a metal paste inside said heat dissipation hole, and adhering a metal plate to the lower part of said ceramic substrate.
[Claim 19] The manufacture approach of the light emitting diode according to claim 17 characterized by being filled up with a metal paste inside said heat dissipation hole, and applying a metal paste to the lower part of said ceramic substrate.
[Claim 20] The manufacture approach of the light emitting diode according to claim 11 characterized by inserting a regulus (lump or slug) inside said heat dissipation hole.
[Claim 21] The manufacture approach of the light emitting diode according to claim 11 characterized by being smaller [said auxiliary ceramic sheet / than said heat dissipation hole] smaller than an LED component, and also preparing a heat dissipation hole further.
[Claim 22] The ceramic substrate which prepares one heat dissipation hole and prepares the electrode of a fixed gestalt in the both sides of the hole concerned, Said heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, The LED component which is electrically connected by said electrode and wire and is mounted on said auxiliary ceramic sheet, Light emitting diode characterized by having the up ceramic sheet prepared on a ceramic substrate while surrounding said LED component, and the insulating layer which seals the LED component in said up ceramic sheet.
[Claim 23] Said auxiliary ceramic sheet is light emitting diode according to claim 22 characterized by establishing one heat dissipation hole in the lower part of an LED component further.
[Claim 24] The phase which is equipped with the ceramic sheet which prepares one heat dissipation hole, prepares the pattern electrode of a fixed gestalt on the ceramic sheet concerned, and manufactures a ceramic substrate, The phase which carries out the laminating of the auxiliary ceramic sheet of a fixed gestalt for said heat dissipation hole on the method of wrap aforementioned ceramic substrate, The phase which carries out the laminating of the up ceramic sheet which prepares opening of a predetermined configuration so that said some of pattern electrodes, and some or all of an auxiliary ceramic sheet may be exposed on said ceramic substrate, The phase which carries out coincidence baking of said ceramic substrate, and the phase of mounting an LED component on said auxiliary ceramic sheet after preparing an electrode on the pattern electrode of said ceramic substrate, The manufacture approach of the light emitting diode characterized by having the phase which seals the LED component in said up ceramic sheet by insulating resin after connecting an LED component to said electrode electrically.
[Claim 25] Said heat dissipation hole so that it may be located on the ceramic substrate which prepares one heat dissipation hole, and said ceramic substrate and an LED component can be mounted A wrap auxiliary ceramic sheet, The electrode of the fixed gestalt prepared in both sides centering on a heat dissipation hole on said auxiliary ceramic sheet, The other electrodes of the fixed pattern which counters with said heat dissipation hole, is located between an auxiliary ceramic sheet and LED, and is prepared on an auxiliary ceramic sheet, The LED

component which is mounted on the other electrodes on said auxiliary ceramic sheet, and is electrically connected with the electrode of an auxiliary ceramic substrate by the wire, Light emitting diode characterized by having the up ceramic sheet by which a laminating is carried out on an auxiliary ceramic sheet while surrounding said LED component, and the insulating layer which seals the LED component in said up ceramic sheet.
[Claim 26] The ceramic substrate which prepares many heat dissipation holes (holes for heat sink), Said heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, The electrode of the fixed pattern prepared centering on said heat dissipation hole on said auxiliary ceramic sheet, The LED component which is electrically connected by said electrode and wire and is mounted on said auxiliary ceramic sheet, Luminescence equipment using the light emitting diode characterized by having the up ceramic sheet by which a laminating is carried out on an auxiliary ceramic sheet while surrounding said LED component, and the insulating layer which seals the LED component in said up ceramic sheet.
[Claim 27] Said auxiliary ceramic sheet is luminescence equipment according to claim 26 characterized by establishing one heat dissipation hole in the lower part of each LED component further.
[Claim 28] A phase equipped with the ceramic substrate which prepares many heat dissipation holes, and the phase which carries out the laminating of the auxiliary ceramic sheet on said ceramic substrate, The phase of preparing the pattern electrode of a fixed gestalt in both sides centering on said heat dissipation hole on said auxiliary ceramic sheet, The phase which carries out the laminating of the up ceramic sheet which prepares opening of a predetermined configuration so that said some of pattern electrodes may be exposed on an auxiliary ceramic sheet, The phase of mounting an LED component on an auxiliary ceramic sheet in the phase which carries out coincidence baking of said ceramic substrate by which a laminating is carried out, and the location which counters with a heat dissipation hole after preparing an electrode on the pattern electrode of said auxiliary ceramic sheet, The manufacture approach of the luminescence equipment characterized by having the phase which seals the LED component in said up ceramic sheet by insulating resin after connecting an LED component to said electrode electrically respectively.
[Claim 29] The manufacture approach of the luminescence equipment according to claim 28 characterized by being smaller [said auxiliary ceramic sheet / than said heat dissipation hole] smaller than an LED component, and also preparing a heat dissipation hole further.
[Claim 30] The ceramic substrate which prepares many heat dissipation holes and prepares the electrode of a fixed gestalt in the both sides of each hole, Said each hole of heat dissipation so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, Many LED components which are electrically connected by said each electrode and wire and are respectively mounted on said auxiliary ceramic sheet, Luminescence equipment using the light emitting diode characterized by having the up ceramic sheet prepared on a ceramic substrate while surrounding said LED component, and the insulating layer which seals the LED component in said up ceramic sheet.
[Claim 31] Said auxiliary ceramic sheet is luminescence equipment using the light emitting diode according to claim 30 characterized by being the auxiliary ceramic sheet which was located on the ceramic substrate and achieved method independence of a wrap of the one heat dissipation hole respectively.
[Claim 32] Said auxiliary ceramic sheet is luminescence equipment using the light emitting diode according to claim 30 characterized by being the auxiliary ceramic sheet which was located on the ceramic substrate and achieved method independence of a wrap of at least one or more heat dissipation holes respectively.
[Claim 33] The phase which is equipped with the ceramic sheet which prepares many heat dissipation holes, prepares the pattern electrode of a fixed gestalt on the ceramic sheet concerned, and manufactures a ceramic substrate, The phase which carries out the laminating of the auxiliary ceramic sheet of a fixed gestalt for said each hole of heat dissipation on the method of wrap aforementioned ceramic substrate, The phase which carries out the laminating of the up ceramic sheet which prepares opening of a predetermined configuration so that said some of pattern electrodes, and some or all of an auxiliary ceramic sheet may be exposed on a ceramic substrate, The phase which carries out coincidence baking of said ceramic substrate, and the

phase of mounting an LED component respectively on said auxiliary ceramic sheet after preparing an electrode on the pattern electrode of said ceramic substrate, The manufacture approach of the luminescence equipment using the light emitting diode characterized by having the phase which seals the LED component in said up ceramic sheet by insulating resin after connecting an LED component to said electrode electrically respectively.

[Claim 34] The manufacture approach of the luminescence equipment using the light emitting diode according to claim 33 characterized by carrying out the laminating of the auxiliary ceramic sheet which achieved method independence of a wrap of the one heat dissipation hole respectively on said ceramic substrate.

[Claim 35] The manufacture approach of the luminescence equipment using the light emitting diode according to claim 33 characterized by carrying out the laminating of the auxiliary ceramic sheet which achieved method independence of a wrap of at least one or more heat dissipation holes on said ceramic substrate.

[Claim 36] For a heat dissipation hole, said ceramic substrate is the manufacture approach of the luminescence equipment using the light emitting diode according to claim 33 characterized by preparing further special heat dissipation opening (openings for heat sink).

[Claim 37] The manufacture approach of the luminescence equipment using the light emitting diode according to claim 33 characterized by establishing one heat dissipation hole in said auxiliary ceramic sheet further at the lower part of each LED component.

[Claim 38] Said heat dissipation hole so that it may be located on the ceramic substrate which prepares many heat dissipation holes, and said ceramic substrate and an LED component can be mounted A wrap auxiliary ceramic sheet, The electrode of the fixed gestalt prepared in both sides centering on a heat dissipation hole on said auxiliary ceramic sheet, The other electrodes of the fixed pattern which counters with said heat dissipation hole, is located between said auxiliary ceramic sheets and LED, and is prepared on an auxiliary ceramic sheet, The LED component which is mounted on the other electrodes on said auxiliary ceramic sheet, and is electrically connected with the electrode of an auxiliary ceramic substrate by the wire, Luminescence equipment using the light emitting diode characterized by having the up ceramic sheet by which a laminating is carried out on an auxiliary ceramic sheet while surrounding said LED component, and the insulating layer which seals the LED component in said up ceramic sheet.

[Claim 39] The luminescence unit assembly of the large area characterized by having much luminescence equipments using light emitting diode according to claim 26.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the luminescence equipment using the high density real wearing light emitting diode and this which are excellent in a heat dissipation property in detail as a thing about light emitting diode, the luminescence equipment which used this, and its manufacture approach, and suitable for the display and lighting facilities of a large area, and its manufacture approach.
[0002]
[Description of the Prior Art] Light emitting diode (henceforth LED) is a kind of a solid-state luminescence display device (indicator). The red (R) whose LED is the three primary colors of light, and the green white light (W) LED applicable to more various fields from the monochrome LED containing (G) and blue (B) were embodied. It developed into LED of a chip (SMD) gestalt with easy mounting from LED of ramp type voice at the substrate, and high density LED mounting of a large area was attained recently. In connection with this, the activity range is expanding the applicable field of LED from a common indicating equipment gradually as well as the source for back lights of a display of luminescence to the next-generation lighting facilities which can substitute for an incandescent lamp, a fluorescent lamp, and a streetlight. In the case of LED lighting facilities, unlike a common fluorescent lamp, a lighting circuit is simple, and an inverter circuit and an iron core stabilizer are unnecessary. Furthermore, the lighting facilities using LED have the advantage in which maintenance and a repair cost can be excluded as compared with a fluorescent lamp since [with little power consumption] a life is long 10 or more times.
[0003] As an example of representation of the white LED applied to said lighting facilities, the light emitting device which consists of LED and a fluorescent substance (phosphor) is indicated by JP,2000-315826,A. The light emitting device by said JP,2000-315826,A changes including the electrode 304 electrically connected by 2nd transparency coating section 306a which is arranged on blue LED303 mounted in the ceramic substrate 301, the 1st transparency coating section 306 which has covered the blue LED chip 303, said LED chip, and the 1st transparency coating section, and contains a fluorescent material, and said LED chip and wire 305, as shown in drawing 15 (a) and (b). Such luminescence equipment irradiates the white light which is a mixed light of the light emitted from an LED chip, and the light emitted from the fluorescent material emit the light which absorbs this light and is different. Said luminescence equipment is excellent in luminous efficiency, and can guide the color mixture light of uniform white. In addition, much LED which can embody the white light is proposed (U.S. Pat. No. 5,998,925, No. 6,069,440).
[0004]
[Problem(s) to be Solved by the Invention] By the way, it is the thermal stress (thermal stress) which is mentioned to the greatest cause concerning property degradation and failure of the application product using such LED. An LED chip emits more heat and said many proposed LED chips present the inclination for heat release to increase in proportion to the total luminescence area, when carrying out high density assembly of the natural common LED chip and using it on a direct same substrate like drawing 15 (b) at a signalling lamp, lighting facilities, etc. Especially, in the case of blue LED, since it has high driver voltage relatively as compared with the high brightness LED of other colors, the phenomenon which temperature increases is shown. It is thought that property degradation of LED and generating of failure are more excessive so that

an LED chip is moreover mounted in high density so that the area of lighting facilities is large. Moreover, existing luminescence equipment has the structure like drawing 15 (b), its heat dissipation property is not good and a limitation is in high density LED chip mounting of a large area.

[0005] This invention is made in view of such a conventional technical problem, and the purpose is offering LED which heat dissipation nature's was excellent in and was suitable for high density assembly. The purpose from which this invention differs is offering the approach of making such LED manufacture easily.

[0006] Also when carrying out high density assembly of the purpose from which this invention differs further to a large area using said LED, it is offering the luminescence equipment which was excellent in the heat dissipation property. Moreover, other purposes of this invention are offering the approach of making such luminescence equipment manufacture easily. And other purposes that this inventions differ further are offering the luminescence unit assembly (light emitting unit assembly for large area) of the large area which used such luminescence equipment.

[0007]

[Means for Solving the Problem] In order to finish said purpose, LED by this invention The ceramic substrate which prepares one heat dissipation hole (a hole for heat sink), Said heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, The electrode which forms a fixed pattern centering on said heat dissipation hole on said auxiliary ceramic sheet, The LED component which is electrically connected by said electrode and wire and is mounted on said auxiliary ceramic sheet, Let it be a summary to have had the up ceramic sheet by which a laminating is carried out on an auxiliary ceramic sheet, and the insulating layer which seals the LED component in said up ceramic sheet, surrounding said LED component. Therefore, it becomes what heat dissipation nature was excellent in and was suitable for high density assembly. Let it be a summary to apply a metal paste along with the contact part of said auxiliary ceramic sheet and ceramic substrate inside said heat dissipation hole. Let it be a summary to fill up with a metal paste inside said heat dissipation hole. Let it be a summary for the lower part of the metal paste with which it fills up inside said heat dissipation hole to adhere to a metal plate along with said ceramic substrate. Let it be a summary to fill up with a metal paste inside said heat dissipation hole, and to apply a metal paste to the lower part of said ceramic substrate. Let it be a summary to insert a regulus (lump or slug) inside said heat dissipation hole. Let it be a summary for said ceramic substrate and an auxiliary ceramic sheet, the ceramic substrate concerned, or an auxiliary ceramic sheet to be an alumina or SiC. Let it be a summary for said electrode to consist of a ceramic substrate side in Ag, nickel, and Au layer. Said insulating layer makes it a summary to be epoxy or Si system transparency resin. Said auxiliary ceramic sheet makes it a summary to establish one heat dissipation hole in the lower part of an LED component further.

[0008] In order to finish said purpose, moreover, the manufacture approach of LED by this invention A phase equipped with the ceramic substrate which prepares one heat dissipation hole, and the phase which carries out the laminating of the auxiliary ceramic sheet on said ceramic substrate, The phase of preparing the pattern electrode of a fixed gestalt centering on said heat dissipation hole on said auxiliary ceramic sheet at both sides, The phase which carries out the laminating of the up ceramic sheet which prepares opening (opening) of a predetermined configuration so that said some of pattern electrodes may be exposed on said ceramic substrate, The phase which carries out coincidence baking (co-fire) of said ceramic substrate by which a laminating is carried out, The phase of mounting an LED component on an auxiliary ceramic sheet in the location which counters with a heat dissipation hole after preparing an electrode on the pattern electrode of said auxiliary ceramic substrate, Let it be a summary to have had the phase which seals the LED component in said up ceramic sheet by insulating resin after connecting an LED component to said electrode electrically respectively. Therefore, LED which heat dissipation nature was excellent in and was suitable for high density assembly is made to manufacture easily. Said ceramic substrate and an auxiliary ceramic sheet, the ceramic substrate concerned, or an auxiliary ceramic sheet makes it a summary to use an alumina or SiC. Let it be a summary for said electrode to galvanize nickel and Au layer in Ag paste layer on a ceramic substrate, and to grow into it. Let it be a summary to be filled up with said insulating resin using

epoxy or Si system transparency resin. Let it be a summary to carry out coincidence baking of said ceramic substrate by which a laminating is carried out at 800-1050 degrees C. Let it be a summary to apply a metal paste along with the contact part of said auxiliary ceramic sheet and ceramic substrate inside said heat dissipation hole. Let it be a summary to be filled up with a metal paste inside said heat dissipation hole. Let it be a summary to be filled up with a metal paste inside said heat dissipation hole, and to adhere a metal plate to the lower part of said ceramic substrate. Let it be a summary to be filled up with a metal paste inside said heat dissipation hole, and to apply a metal paste to the lower part of said ceramic substrate. Let it be a summary to insert a regulus (lump or slug) inside said heat dissipation hole. Are smaller [said auxiliary ceramic sheet / than said heat dissipation hole] smaller than an LED component, and also let it be a summary to prepare a heat dissipation hole further.

[0009] In order to finish said purpose, furthermore, LED by this invention The ceramic substrate which prepared one heat dissipation hole (a hole for heat sink), and prepared the electrode of a fixed gestalt in the both sides of this hole, Said heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, The LED component which was electrically connected by said electrode and wire and was mounted on said auxiliary ceramic sheet, It changes including the insulating layer which has sealed the LED component the up ceramic sheet prepared on the ceramic substrate, and in said up ceramic sheet, surrounding said LED component. Therefore, it becomes what heat dissipation nature was excellent in and was suitable for high density assembly. Said auxiliary ceramic sheet makes it a summary to establish one heat dissipation hole in the lower part of an LED component further.

[0010] In order to finish said purpose, moreover, the manufacture approach of LED by this invention The phase which is equipped with the ceramic sheet which prepared one heat dissipation hole (a hole for heat sink), prepares the pattern electrode of a fixed gestalt on the ceramic sheet concerned, and manufactures a ceramic substrate, The phase which carries out the laminating of the auxiliary ceramic sheet of a fixed gestalt for said heat dissipation hole on the method of wrap aforementioned ceramic substrate, The phase which carries out the laminating of the up ceramic sheet which prepared opening (opening) of a predetermined configuration so that said some of pattern electrodes, and some or all of an auxiliary ceramic sheet might be exposed on a ceramic substrate, The phase of mounting an LED component on said auxiliary ceramic sheet after preparing an electrode on the phase which carries out coincidence baking (co-fire) of said ceramic substrate, and the pattern electrode of said ceramic substrate, And after connecting an LED component to said electrode electrically, it changes including the phase which seals the LED component in said up ceramic sheet by insulating resin. Therefore, LED which heat dissipation nature was excellent in and was suitable for high density assembly is made to manufacture easily.

[0011] In order to finish said purpose, furthermore, LED by this invention Said heat dissipation hole so that it may be located on the ceramic substrate which prepares one heat dissipation hole, and said ceramic substrate and an LED component can be mounted A wrap auxiliary ceramic sheet, The electrode of the fixed gestalt prepared in both sides centering on a heat dissipation hole on said auxiliary ceramic sheet, The other electrodes of the fixed pattern which counters with said heat dissipation hole, is located between an auxiliary ceramic sheet and LED, and is prepared on an auxiliary ceramic sheet, The LED component which is mounted on the other electrodes on said auxiliary ceramic sheet, and is electrically connected with the electrode of an auxiliary ceramic substrate by the wire, Let it be a summary to have had the up ceramic sheet by which a laminating is carried out on an auxiliary ceramic sheet, and the insulating layer which seals the LED component in said up ceramic sheet, surrounding said LED component. Therefore, it becomes what heat dissipation nature was excellent in and was suitable for high density assembly.

[0012] In order to finish the purpose besides the above, the luminescence equipment using LED by this invention The ceramic substrate which prepares many heat dissipation holes (holes for heat sink), Said heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, The electrode of the fixed pattern prepared centering on said heat dissipation hole on said auxiliary ceramic sheet, The LED component which is electrically connected by said electrode and wire and is mounted on said auxiliary ceramic sheet, Let it be a summary to have had the up ceramic

sheet by which a laminating is carried out on an auxiliary ceramic sheet, and the insulating layer which seals the LED component in said up ceramic sheet, surrounding said LED component. Therefore, also when high density assembly was carried out to a large area using said LED, the heat dissipation property should be excellent. Said auxiliary ceramic sheet makes it a summary to establish one heat dissipation hole in the lower part of each LED component further.

[0013] In order to finish the purpose besides the above, moreover, the manufacture approach of the luminescence equipment using LED by this invention A phase equipped with the ceramic substrate which prepares many heat dissipation holes, and the phase which carries out the laminating of the auxiliary ceramic sheet on said ceramic substrate, The phase of preparing the pattern electrode of a fixed gestalt in both sides centering on said heat dissipation hole on said auxiliary ceramic sheet, The phase which carries out the laminating of the up ceramic sheet which prepares opening of a predetermined configuration so that said some of pattern electrodes may be exposed on an auxiliary ceramic sheet, The phase of mounting an LED component on an auxiliary ceramic sheet in the phase which carries out coincidence baking of said ceramic substrate by which a laminating is carried out, and the location which counters with a heat dissipation hole after preparing an electrode on the pattern electrode of said auxiliary ceramic sheet, Let it be a summary to have the phase which seals the LED component in said up ceramic sheet by insulating resin after connecting an LED component to said electrode electrically respectively. Therefore, also when carrying out high density assembly to a large area using said LED, the luminescence equipment which should be excellent in the heat dissipation property is made to manufacture easily. Are smaller [said auxiliary ceramic sheet / than said heat dissipation hole] smaller than an LED component, and also let it be a summary to prepare a heat dissipation hole further.

[0014] In order to finish the purpose besides the above, furthermore, the luminescence equipment using LED by this invention The ceramic substrate which prepared many heat dissipation holes (holes for heat sink), and prepared the electrode of a fixed gestalt in the both sides of each hole, Said each heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, Many LED components which were electrically connected by said each electrode and wire and were respectively mounted on said auxiliary ceramic sheet, It changes including the insulating layer which seals the LED component the up ceramic sheet prepared on the ceramic substrate, and in said up ceramic sheet, surrounding said many LED components. Therefore, also when high density assembly was carried out to a large area using said LED, the heat dissipation property should be excellent. Let it be a summary for said auxiliary ceramic sheet to be an auxiliary ceramic sheet which was located on the ceramic substrate and achieved method independence of a wrap of the one heat dissipation hole respectively. Let it be a summary for said auxiliary ceramic sheet to be an auxiliary ceramic sheet which was located on the ceramic substrate and achieved method independence of a wrap of at least one or more heat dissipation holes respectively.

[0015] In order to finish the purpose besides the above, moreover, the manufacture approach of the luminescence equipment using LED by this invention The phase which is equipped with the ceramic sheet which prepared many heat dissipation holes, prepares the pattern electrode of a fixed gestalt on the ceramic sheet concerned, and manufactures a ceramic substrate, The phase which carries out the laminating of the auxiliary ceramic sheet of a fixed gestalt for said each heat dissipation hole on the method of wrap aforementioned ceramic substrate, The phase which carries out the laminating of the up ceramic sheet which prepared opening of a predetermined configuration so that said some of pattern electrodes, and some or all of an auxiliary ceramic sheet might be exposed on a ceramic substrate, The phase of mounting many LED components respectively on said auxiliary ceramic sheet after preparing an electrode on the phase which carries out coincidence baking of said ceramic substrate, and the pattern electrode of said ceramic substrate, After connecting an LED component to said electrode electrically respectively, it changes including the phase which seals the LED component in said up ceramic sheet by insulating resin. Therefore, also when carrying out high density assembly to a large area using said LED, the luminescence equipment which should be excellent in the heat dissipation property is made to manufacture easily. Let it be a summary to carry out the laminating of the auxiliary ceramic sheet which achieved method independence of a wrap of the one heat dissipation hole respectively on said ceramic substrate. Let it be a summary to carry out the

laminating of the auxiliary ceramic sheet which achieved method independence of a wrap of at least one or more heat dissipation holes on said ceramic substrate. Said ceramic substrate makes it a summary to prepare further heat dissipation opening (openings for heat sink) with a special heat dissipation hole. Let it be a summary to establish one heat dissipation hole in the lower part of each LED component further at said auxiliary ceramic sheet.
[0016] In order to finish said purpose, furthermore, the luminescence equipment using LED by this invention Said heat dissipation hole so that it may be located on the ceramic substrate which prepares many heat dissipation holes, and said ceramic substrate and an LED component can be mounted A wrap auxiliary ceramic sheet, The electrode of the fixed gestalt prepared in both sides centering on a heat dissipation hole on said auxiliary ceramic sheet, The other electrodes of the fixed pattern which counters with said heat dissipation hole, is located between said auxiliary ceramic sheets and LED, and is prepared on an auxiliary ceramic sheet, The LED component which is mounted on the other electrodes on said auxiliary ceramic sheet, and is electrically connected with the electrode of an auxiliary ceramic substrate by the wire, Let it be a summary to have had the up ceramic sheet by which a laminating is carried out on an auxiliary ceramic sheet, and the insulating layer which seals the LED component in said up ceramic sheet, surrounding said LED component. Therefore, also when high density assembly was carried out to a large area using said LED, the heat dissipation property should be excellent.
[0017] In order to finish the above and also other purposes, the luminescence unit assembly luminescence equipment using LED by this invention makes it a summary to have much luminescence equipments which used light emitting diode according to claim 26. Therefore, the luminescence unit assembly of a large area is realizable.
[0018]
[Embodiment of the Invention] Hereafter, this invention is explained to a detail. This invention minimizes the thermal stress of LED and the luminescence equipment using this by various heat dissipation designs. In connection with this, this invention raises an LED property and will become very useful as a source of luminescence of next-generation lighting facilities.
[0019] (LED and its manufacture approach) Drawing 1 shows an example of LED by this invention. Drawing 1 (a) is the cross-section block diagram of LED which is the gestalt of 1 operation of this invention, and drawing 1 (b) is the top view. After LED by this invention contains the auxiliary ceramic sheet 12 by which the laminating was carried out on the ceramic substrate 11 and said ceramic substrate 11, the up ceramic sheet 16, a light emitting device 13, and an electrode 14 if it is divided roughly as shown in drawing 1 (a) and (b), it changes.
[0020] Said ceramic substrate 11 is equipped with one heat dissipation hole 11a in the gestalt of this operation. Furthermore, on the front face of a ceramic substrate 11, the pattern electrode of a fixed gestalt is prepared at the both sides of said heat dissipation hole 11a. Said heat dissipation hole is very suitable for emitting the heat which it has been arranged at the lower part of an LED component, and was generated from the LED component to the direct air, and minimizing the thermal stress of LED. Of course, there may not be need that a heat dissipation hole is not necessarily circular, and what kind of configurations, such as a rectangular head or a polygon, are sufficient as it. As long as said ceramic substrate is a substrate which can carry out high density assembly of the LED component, what kind of thing is sufficient as it. For example, an alumina (alumina), Xtal (quartz), calcium zirconate (calcium zirconate), olivine (forsterite), SiC, a graphite, a melting silica (fused silica), a mullite (mullite), cordierite (cordierite), a zirconia (zirconia), beryllia (beryllia), alumimium nitride (aluminum nitride), etc. can be mentioned as such a ceramic substrate. Therefore, although the quality of the material of a ceramic substrate is not limited specially, an alumina or the SiC quality of the material is suitable especially. It is using an alumina more preferably. An alumina ceramic has electric insulation and high thermal conductivity. Furthermore, the alumina ceramic is excellent in thermal resistance, chemical resistance, and a mechanical strength, and has the advantage in which there is little especially radiation emission. Furthermore, on it, an alumina ceramic can prepare a metallic conductor circuit pattern, and can use it as a laminating mold ceramic package (multi-layer ceramic package; MLP) according to a baking process. Airtightness is excellent when used as such a package.
[0021] Said auxiliary ceramic sheet 12 is a wrap about said heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted. It is most suitable to use an alumina or the SiC quality of the material like [the auxiliary ceramic sheet 12] the

above. Said auxiliary ceramic sheet may be variously constituted irrespective of the gestalt and configuration. Although only shown by the rectangular head or the rhombus in drawing 1 (b), it can consist of various gestalten so that it may be shown variously henceforth. LED13 of a light emitting device is electrically connected by the electrode 14 and wire 15 which were mounted on said auxiliary ceramic sheet and prepared on the ceramic substrate, its outcrossing line pattern, etc. LED by this invention is applicable irrespective of the gestalt and class of LED component. Therefore, it cannot be overemphasized that RGB LED can be applied not only to the white light LED but to the LED component of various hues, of course. An LED component is surrounded with the up ceramic sheet 17 prepared on the ceramic substrate along the perimeter of a ceramic substrate, and is sealed by the insulating layer 16.

[0022] Said insulating layer 16 protects an LED component from external physical / chemical erosion, and it consists of the transparence quality of the material so that the light irradiated from an LED component may be passed. As the quality of the material of a desirable insulating layer, epoxy or Si system transparency resin can be mentioned.

[0023] Drawing 2 (a) and (b) show the gestalt of the operation from which LED by this invention differs. In the various kinds LED of drawing 2 (a) and (b), each agreement supports drawing 1 (a) and (b) so that it may be easy to understand. First, drawing 2 (a) shows LED in which other heat dissipation hole 22a was prepared to said auxiliary ceramic sheet 22 with which the LED component 23 was mounted. As for said other heat dissipation hole 22a, it is natural that it is smaller than the LED component 23. Furthermore, it is desirable to prepare smaller than heat dissipation hole 21a of a ceramic substrate 21. It is predicted that LED of drawing 2 (a) is excellent in a heat dissipation property as compared with LED shown in drawing 1 in order that the LED component 23 may contact direct air.

[0024] To drawing 2 (b), LED of the gestalt of further different operation of this invention is illustrated. Unlike LED shown in drawing 2 (a), it consists of the structure where the laminating of the auxiliary ceramic sheet 32 was continued and carried out to the ceramic substrate 31 whole. Furthermore, it is located in the auxiliary ceramic sheet 32 whose electrode 34 is not a ceramic substrate, either. LED which consists of such structure has a big advantage in a production process so that it may explain henceforth.

[0025] Furthermore, LED illustrated to drawing 2 (c) has prepared one heat dissipation hole 42a in the auxiliary ceramic sheet 42 further in the LED structure of drawing 2 (b). LED illustrated to drawing 2 (c) is equipped with all the advantages of LED illustrated to drawing 2 (a) and drawing 2 (b). Namely, in a production process, emission of the heat generated from LED is not only easy, but has a big advantage.

[0026] LED illustrated above corresponds, when it has the electrode which was suitable in use of the blue which used the nitride compound as an LED component, or a white light LED component. However, in the case of the LED component which consists of other semiconducting compounds, i.e., GaAs, GaP and SiC, ZnSe, etc., it is based on the electrical conductivity of the substrate itself, and an electric-field impression method is held by the LED component top and the lower part. Therefore, as for the LED component in this case, a lower electrode is prepared caudad. An example of LED suitable for such an LED component is shown in drawing 2 (d). Electrode structure differs from LED which illustrated previously LED illustrated to drawing 2 (d) greatly. Therefore, as for the LED component 53 mounted on the auxiliary ceramic sheet 52, lower other electrode 54a may be electrically connected with an electrode 54 by wire 55 grade. In this case, although heat dissipation hole 51a is prepared in the ceramic substrate 51, a heat dissipation hole can be established also in an auxiliary ceramic sheet.

[0027] Although LED explained above can stop the thermal stress of LED effectively by various heat dissipation designs, each LED may promote a heat dissipation property more effectively by the approach with which applies a conductive ingredient to a heat dissipation hole, or it is filled up. To drawing 3 R> 3, the method applied to LED of drawing 1 is illustrated. On the other hand, drawing 3 (a) shows as a formula the LED by which metal paste 18a was applied along the contact surface of the auxiliary ceramic sheet 12 and a ceramic substrate 11 inside heat dissipation hole 11a. Furthermore, drawing 3 (b) illustrates LED with which metal paste 18b was filled up inside said heat dissipation hole 11a. Furthermore, drawing 3 (c) is LED in which the lower part of LED of drawing 3 (b) with which the metal paste was filled up inside heat dissipation hole 11a adhered to the metal plate 19 along with the ceramic substrate 11. Drawing 3 (d) shows LED which 18d (lump or slug) of reguluses was inserted inside heat dissipation hole

11a, and was pasted up with a metal paste. LED shown in drawing 3 R> 3 (e) is the structure where filled up with the metal paste upwards inside heat dissipation hole 11a, and metal paste 18e was altogether applied along with the lower part of a ceramic substrate 11. All of these LED are excellent in the heat dissipation property as compared with the case where only a heat dissipation hole is prepared, in order that thermal emission may carry out more easily by heat dissipation hole 11a. It cannot be overemphasized that such structure can be identically applied not only to LED illustrated to drawing 1 , of course but to LED of drawing 2 by which the heat dissipation design was carried out variously.

[0028] LED which has such various heat dissipation structures is manufactured through the process like a degree. That is, for example, the manufacture approach of LED of drawing 1 is equipped with the ceramic sheet 11 which prepared one heat dissipation hole 11a first. The heat dissipation hole of said ceramic sheet can be easily prepared by punching. Subsequently, on a ceramic sheet, the pattern electrode 14 of a fixed gestalt is formed with a screen-stencil method etc. It cannot be overemphasized that said pattern electrode can be variously changed by design. In this invention, Ag content paste is suitable as a pattern electrode. Said ceramic substrate can carry out the laminating of one piece or the two ceramic sheets or more, and can constitute them. Furthermore, other circuit patterns can be prepared in a ceramic substrate as occasion demands. After having said ceramic substrate, the laminating of the auxiliary ceramic sheet 12 of the fixed gestalt which can cover said heat dissipation hole is carried out. What is necessary is just to make the auxiliary ceramic sheet 32 into the same magnitude as a ceramic substrate 31 in the case of LED illustrated by drawing 2 (b).

[0029] Subsequently, it has the up ceramic sheet 17 with which opening (opening) of a predetermined configuration was prepared so that said some of pattern electrodes, and some or all of an auxiliary ceramic sheet may be exposed, and the laminating of this is carried out on a ceramic substrate. Then, said ceramic substrate performs coincidence baking. Under the present circumstances, it is desirable to perform coincidence baking at about 800-1050 degrees C.

[0030] Then, an electrode is prepared with plating on the pattern electrode of said ceramic substrate. As for an electrode, in this invention, it is desirable to galvanize nickel and Au one by one in Ag paste layer on a ceramic substrate. After preparing said electrode, the LED component 13 prepared on the auxiliary ceramic sheet 12 is mounted. Then, since said electrode and LED component are electrically connected with a wire 15, the LED component 13 in said up ceramic sheet 17 is sealed by insulating resin.

[0031] (Luminescence equipment and its manufacture approach) On the other hand, this invention offers the luminescence equipment with which thermal stress is sharply reduced using LED which is the fundamental unit light emitting device obtained by the aforementioned various heat dissipation designs. The luminescence equipment of this invention does not mount LED of said item in one PCB substrate, but mounts it on the metal pattern electrode which continues within the package which unified the LED component.

[0032] Drawing 4 shows an example of luminescence equipment which used LED of this invention. Drawing 4 (a) is the cross-section configuration of the luminescence equipment which is the gestalt of 1 operation of this invention, and drawing 4 (b) is the top view. the auxiliary ceramic sheet 112 by which divided roughly and the laminating was carried out on the ceramic substrate 111 and said ceramic substrate as the luminescence equipment by this invention was shown in drawing 4 , 112', and the up ceramic sheet 116 and light emitting devices 113 and 113 - - ' And it changes including an electrode 114. Such luminescence equipment has the **** structure which combined much LED of drawing 1 .

[0033] Concretely, in the gestalt of this operation, said ceramic substrate 111 has prepared many heat dissipation hole 111a and 111a'. Furthermore, on the front face of a ceramic substrate 111, the pattern electrode of a fixed gestalt is prepared at the both sides of said heat dissipation hole 111a and 111a'. Said heat dissipation hole is very suitable for emitting the heat which it has been arranged at the lower part of an LED component, and was generated from the LED component to the direct air, and minimizing the thermal stress of LED as above-mentioned. Of course, what kind of configuration is sufficient as a heat dissipation hole. As long as a ceramic substrate is a substrate which can carry out high density assembly of the LED component, what kind of thing is sufficient as it. Although the quality of the material of a ceramic substrate is limited specially and does not have an end as above-mentioned, an alumina or the SiC quality of the material is suitable for it especially. It is using an alumina more preferably.

[0034] Said auxiliary ceramic sheet 112 and 112' have covered said heat dissipation hole so that it may be located on said ceramic substrate and each LED component can be mounted. It is most suitable that the auxiliary ceramic sheet 112 and 112' as well as the above use an alumina or the SiC quality of the material. Said auxiliary ceramic sheet can be variously constituted irrespective of the gestalt and configuration. Although it only consists of the rectangular head or the rhombus in drawing 1 (b), it can consist of various gestalten so that it may show variously henceforth. Furthermore, in drawing 4 (a), auxiliary ceramic sheets are the auxiliary ceramic sheet which was located on the ceramic substrate 111 and achieved wrap independence of the one heat dissipation hole 111a respectively, and an auxiliary ceramic sheet which achieved method independence of a wrap of at least one or more heat dissipation holes respectively (refer to drawing 2 (b), drawing 2 (c), drawing 11 (b), and drawing 12 R> 2 (b)).

[0035] LED113 and 113' which are a light emitting device are mounted on said auxiliary ceramic sheet, and are electrically connected by the electrode 114 and wire 115 which were prepared on the ceramic substrate, its outcrossing line pattern, etc. LED mounted in the luminescence equipment by this invention is applicable irrespective of the gestalt and class of LED component. Therefore, it cannot be overemphasized that RGB LED can be applied not only to the white light LED but to the LED component of various hues, of course. An LED component is surrounded with the up ceramic sheet 117 prepared on the ceramic substrate along the perimeter of a ceramic substrate, and is sealed by the insulating layer 116. As for said insulating layer 116, it is desirable to consist of epoxy or Si system transparency resin.

[0036] Drawing 5 shows the gestalt of the operation from which the luminescence equipment by this invention differs. In the various luminescence equipments of drawing 5 , each agreement supports drawing 4 so that it may be easy to understand. First, drawing 5 (a) shows the LED component 123, said auxiliary ceramic sheet 122 with which 123' was mounted, and the luminescence equipment with which other heat dissipation hole 122a and 122a' was prepared in 122'. Such luminescence equipment has the **** structure which combined much LED of drawing 2 (a). It cannot be overemphasized that heat dissipation hole 122a and 122a' is smaller than the LED component 123 and 123' in the luminescence equipment by drawing 5 (a). Furthermore, it is desirable to form smaller than heat dissipation hole 121a of a ceramic substrate 121 and 121a'. It is predicted that a heat dissipation property is excellent as compared with the luminescence equipment which showed the luminescence equipment by drawing 5 (a) to drawing 4 in order that the LED component 123 and 123' might contact direct air.

[0037] To drawing 5 (b), the luminescence equipment of the gestalt of further different operation of this invention is illustrated. Unlike the luminescence equipment illustrated by drawing 4 , the luminescence equipment shown in drawing 5 (b) has the structure where the laminating of the auxiliary ceramic sheet 132 is continued and carried out to the ceramic substrate 131 whole. Furthermore, an electrode 134 is also located in the auxiliary ceramic sheet 132 instead of a ceramic substrate. Such luminescence equipment has the structure which combined LED of a large number illustrated to drawing 2 (b), and as shown in future manufacture processes, it has a big advantage.

[0038] Furthermore, the luminescence equipment illustrated to drawing 6 (a) has prepared further one heat dissipation hole 142a and 142a' in the auxiliary ceramic sheet 142 in the structure of the luminescence equipment of drawing 5 R> 5 (b). Such luminescence equipment has the structure which combined LED of a large number illustrated to drawing 2 (c).

[0039] The luminescence equipment shown in drawing 6 (b) shows the case of being suitable for the structure which combined the LED component of a large number illustrated to drawing 2 (b). That is, an electric-field impression method is held by an LED component top and the lower part with the electrical conductivity of the substrate itself as what has the structure which combined the LED component of a large number which illustrated such luminescence equipment to drawing 2 (d). said luminescence equipment -- the auxiliary ceramic sheet 152 and 152' -- it is located in the LED component 153 mounted upwards and the lower part of 153', and also electrode 154a and 154' are electrically connected with an electrode 154 and 154' by a wire 155, 155', etc. In this case, although heat dissipation hole 151a is prepared in the ceramic substrate 151, a heat dissipation hole can be further prepared also on an auxiliary ceramic sheet.

[0040] Although the luminescence equipment explained above can stop the thermal stress of LED effectively by various heat dissipation designs, each luminescence equipment can increase a heat dissipation property more effectively by the approach with which applies a conductive

ingredient to a heat dissipation hole, or it is filled up. To drawing 7 , the method applied to the luminescence equipment of drawing 4 is illustrated. As for drawing 7 (a), the luminescence equipment with which metal paste 118a was applied inside heat dissipation hole 111a as a formula on the other hand is shown along the contact surface of the auxiliary ceramic sheet 112 and a ceramic substrate 111. Furthermore, drawing 7 (b) has illustrated the luminescence equipment with which it filled up with metal paste 118b inside said heat dissipation hole 111a. Furthermore, drawing 7 (c) is luminescence equipment with which the lower part of LED adhered to the metal plate 119 along with the ceramic substrate 111 in the luminescence equipment of drawing 7 (b) with which it filled up with the metal paste inside heat dissipation hole 111a. Drawing 8 (a) shows the luminescence equipment which 118d (lump or slug) of reguluses was inserted inside heat dissipation hole 111a, and was pasted up with a metal paste. The luminescence equipment illustrated to drawing 8 (b) is the structure where filled up with the metal paste upwards inside heat dissipation hole 111a, and metal paste 118e was altogether applied along with the lower part of a ceramic substrate 111. All of these luminescence equipments are excellent in the heat dissipation property as compared with the case where thermal emission is more easily prepared only in a deed heat dissipation hole by heat dissipation hole 111a. It cannot be overemphasized that such structure can be identically applied not only to the luminescence equipment illustrated to drawing 4 , of course but to drawing 5 and the luminescence equipment of 6 by which the heat dissipation design was carried out variously.

[0041] As for the production process of luminescence equipment which has such various heat dissipation structures, it is more various that it is fundamentally similar with the LED production process of an item. It will be as follows if the manufacture approach of this invention in the luminescence equipment illustrated by drawing 4 is explained based on drawing 9 . As shown in drawing 9 (a) and drawing 9 (b), it has the ceramic sheet which prepared many heat dissipation hole 111a and 111a' according to the punching process first. On this ceramic sheet, the pattern electrode 114 of a fixed gestalt is formed with a screen-stencil method etc. like drawing 9 (c). It cannot be overemphasized that said pattern electrode 114 can be variously changed by design. In this invention, Ag content paste is suitable as a pattern electrode. A ceramic substrate can carry out the laminating of one piece or the two ceramic sheets or more, and can constitute them. Furthermore, other circuit patterns can be prepared in a ceramic substrate as occasion demands. After having said ceramic substrate, the laminating of the auxiliary ceramic sheet 112 of the fixed gestalt which can cover said heat dissipation hole, and 112' is carried out like drawing 9 (d). Although said auxiliary ceramic sheet can be prepared so that one heat dissipation hole may be respectively covered on said ceramic substrate, at least one or more heat dissipation holes can also consist of auxiliary ceramic sheets which achieved method independence of a wrap. Drawing 10 shows such an example. After carrying out the laminating of the independent auxiliary ceramic sheet 162 which can cover a series of heat dissipation holes 161a, 161b, and 161c of a ceramic substrate 161 on a ceramic substrate 161, the process which carries out the laminating of the up ceramic sheet 167 is shown [in / both / the production process of the heat radiator shown in drawing 10 (a) thru/or drawing 10 (c)]. Furthermore, said auxiliary ceramic sheet can also be constituted so that one heat dissipation hole may be respectively established further in the lower part of an LED component (refer to drawing 5 (a)).

[0042] Subsequently, like drawing 9 (e), it has the up ceramic sheet 117 which prepared opening of a predetermined configuration so that said some of pattern electrodes, and some or all of an auxiliary ceramic sheet may be exposed, and a laminating is carried out on said ceramic substrate. Then, said ceramic substrate performs coincidence baking. Under the present circumstances, it is desirable to perform coincidence baking at about 800-1050 degrees C. Then, an electrode is prepared with plating on the pattern electrode of said ceramic substrate like drawing 9 (f). As for an electrode, in this invention, it is desirable to galvanize nickel and Au one by one in Ag paste layer on a ceramic substrate. After preparing said electrode, the auxiliary ceramic sheet 112, the LED component 113 which it had on 112', and 113' are mounted. Then, since said electrode 114 and LED component are electrically connected with a wire, the LED component 113 in said up ceramic sheet 117 and 113' are sealed by insulating resin.

[0043] Drawing 11 shows the production process from which the luminescence equipment by this invention differs further. Probably, the luminescence equipment pass such a production process has the structure like drawing 6 (a). Unlike the production process of drawing 9 , the production process shown in drawing 11 R> 1 has the advantage that one auxiliary ceramic sheet 152 may

be used, and a production process may actually be simplified sharply. A pattern electrode is not prepared on the ceramic substrate 151 which prepared heat dissipation hole 151a and 151a', but the manufacture approach of the luminescence equipment proposed to drawing 1111 is established on the auxiliary ceramic sheet 152. That is, it has the auxiliary ceramic sheet which it was smaller [than said heat dissipation hole 151a and 151a'] smaller than the LED component, and also prepared heat dissipation hole 152a and 152a' according to the punching process, and after carrying out a laminating so that the center line of a heat dissipation hole may be in agreement on said ceramic substrate (drawing 11 (c)), the pattern electrode 154 of a fixed gestalt is formed on an auxiliary ceramic sheet (drawing 11 (d)). Future production processes are the same as that of drawing 9 .

[0044] The production process of the luminescence equipment by this invention can also prepare heat dissipation opening (openings for heat sink) with the special heat dissipation hole of not only this but said ceramic substrate. Drawing 1212 shows such an example. In case a ceramic substrate 171 is manufactured to drawing 12 , heat dissipation hole 171a and 171a' shows the process which pierced the special heat dissipation means like heat dissipation opening by punching around said heat dissipation hole separately. Since the luminescence equipment which has such structure can radiate heat in the air very much in a larger area in the heat generated from the LED component, using much luminescence equipments, it is high-density, can combine a luminescence unit assembly, and has the advantage that the luminescence side of a luminescence unit assembly can be further constituted more in a large area.

[0045] In the manufacture approach of this invention, the up ceramic sheet 177 can consist of various gestalten. An up ceramic sheet can be designed in various configurations according to external environments, such as a user or a service condition. Drawing 13 R> 3 has illustrated the various configurations of an up ceramic sheet. In opening or the aperture (windows) of said up ceramic sheet shown in drawing 13 , the number of LED is arranged appropriately, and the area and the gestalt of a luminescence side can be determined efficiently.

[0046] (Luminescence unit assembly) At least one or more luminescence equipments explained in this invention until now can be arranged, and the luminescence unit assembly of a large area can be constituted. Drawing 14 omitted the up ceramic sheet in the drawing so that easily [an understanding] as an example of the assembly of such a luminescence unit. The luminescence unit assembly by this invention arranges the luminescence unit 210 appropriately, and changes. Furthermore, since a configuration and a gestalt are appropriately formed in the upper part for the up ceramic sheet by which a laminating is carried out by punching in a luminescence unit assembly and the configuration of luminescence area and a luminescence side can be adjusted, the amount of the light irradiated from an LED component can also be adjusted. Since emission of the heat which various heat dissipation designs can be performed and is generated from an LED component is easy for especially the luminescence unit assembly of this invention, an LED component can be designed to a high density large area.

[0047]

[Effect of the Invention] Like ****, LED by this invention emits efficiently the heat generated from an LED component by various heat dissipation designs, and thermal stress of an LED component is made as for it to minimization, and it can perform stable actuation of an LED component. Furthermore, this invention offers the luminescence equipment which can mount an LED component in a large area substrate by high density. Such luminescence equipment fits very much the next-generation lighting facilities which can substitute for not only sources of luminescence, such as a display which presents various hues (full color), but an incandescent lamp, a fluorescent lamp, and a streetlight.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of the light emitting diode by this invention.
[Drawing 2] It is the sectional view of different light emitting diode by this invention.
[Drawing 3] It is the sectional view of further different light emitting diode by this invention.
[Drawing 4] It is the block diagram of the luminescence equipment by this invention.
[Drawing 5] It is the sectional view of different luminescence equipment by this invention.
[Drawing 6] It is the sectional view of different luminescence equipment by this invention.
[Drawing 7] It is the sectional view of further different luminescence equipment by this invention.

[Drawing 8] It is the sectional view of further different luminescence equipment by this invention.

[Drawing 9] The production process Fig. of the luminescence equipment by this invention is illustrated.
[Drawing 10] It is a part of production process from which the luminescence equipment by this invention differs.
[Drawing 11] The production process Fig. where the luminescence equipment by this invention differs further is illustrated.
[Drawing 12] It is a part of production process from which the luminescence equipment by this invention differs further.
[Drawing 13] It is the instantiation Fig. of the up ceramic sheet of the luminescence equipment by this invention.
[Drawing 14] It is the block diagram of the large area luminescence equipment using the light emitting device by this invention.
[Drawing 15] (a) is the sectional view of the conventional light emitting device, and (b) is the sectional view of the luminescence equipment which used the light emitting device of (a).
[Description of Notations]
111, 121, 131, 141, 151, 161, 171 Ceramic substrate
111a, 121a, 131a, 141a, 151a, 161a, a 171a heat dissipation hole
112, 122, 132, 142, 152, 162, 172 Auxiliary ceramic sheet
113, 123, 133, 143, 153, 163, 173 Light emitting diode
114, 124, 134, 144, 154, 164, 174 Electrode
115, 125, 135, 145, 155, 165, 175 Wire
116, 126, 136, 146, 156, 166, 176 Insulating layer
117, 127, 137, 147, 157, 167, 177 Up ceramic sheet

[Translation done.]

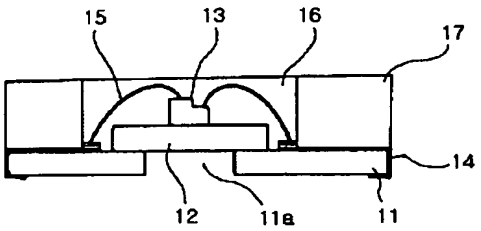
* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

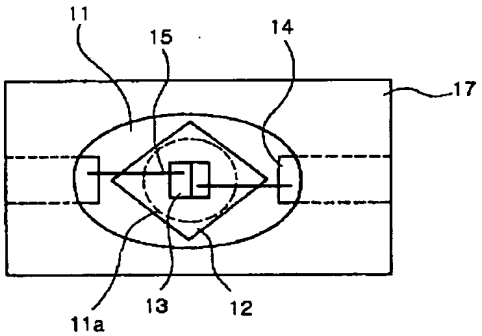
DRAWINGS

[Drawing 1]

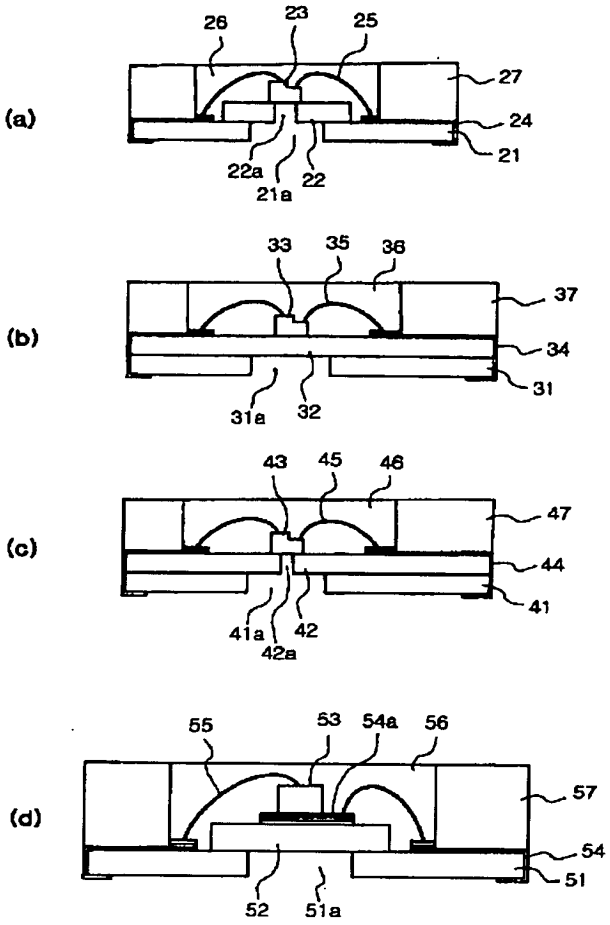
(a)



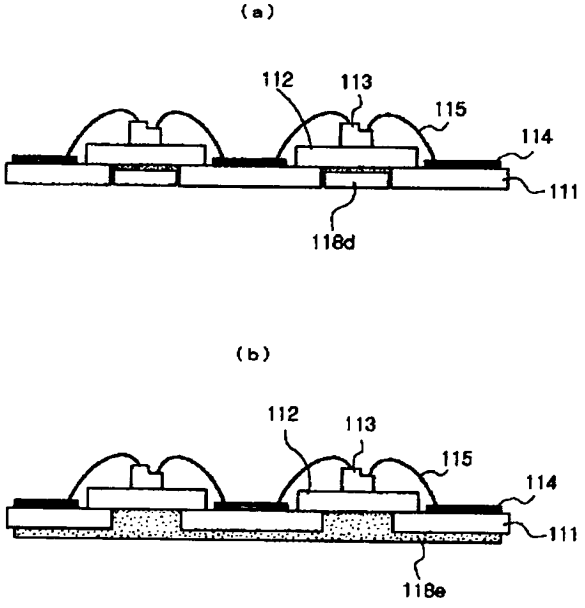
(b)



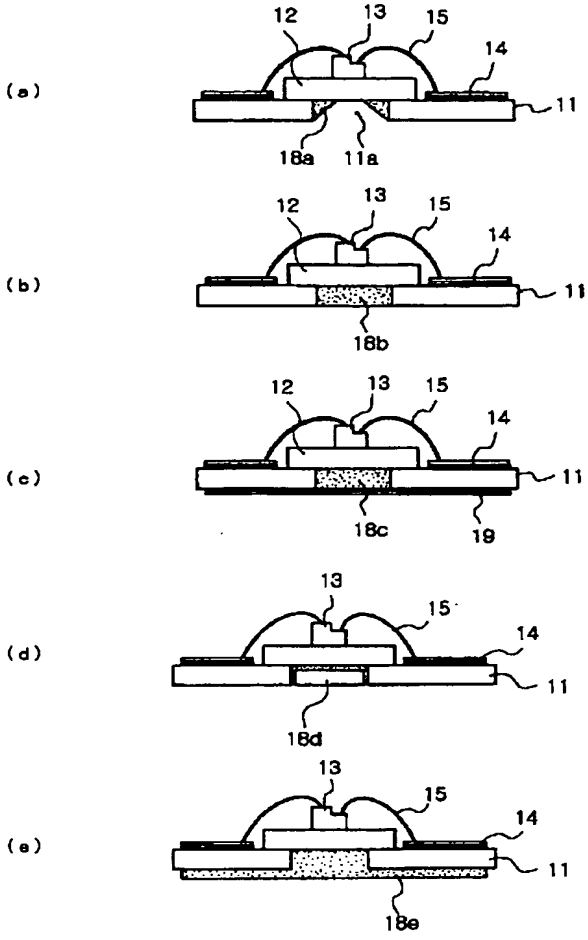
[Drawing 2]



[Drawing 8]

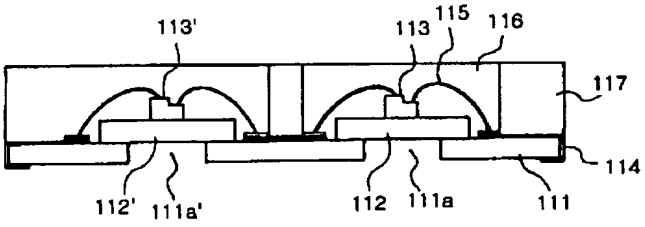


[Drawing 3]

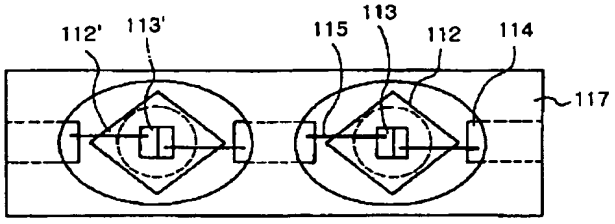


[Drawing 4]

(a)

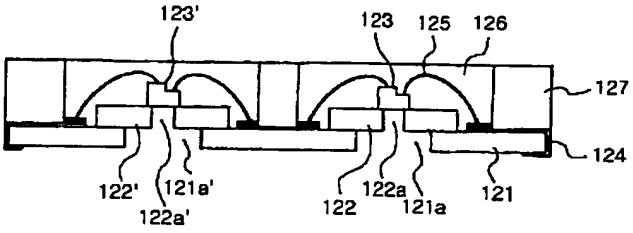


(b)

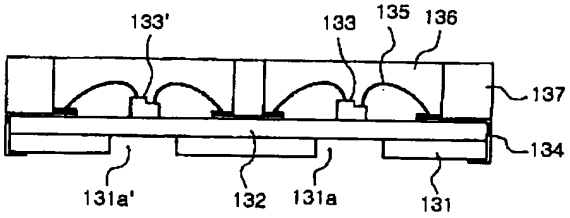


[Drawing 5]

(a)

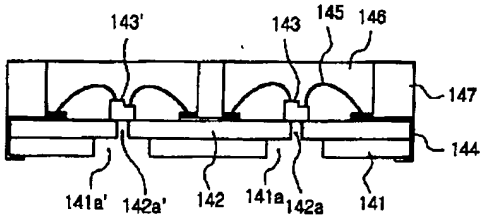


(b)

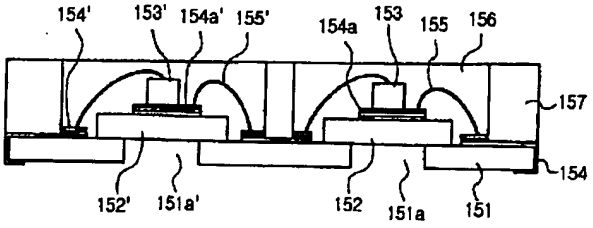


[Drawing 6]

(a)

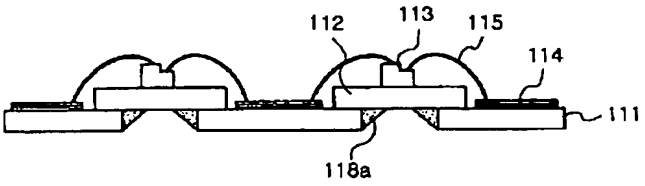


(b)

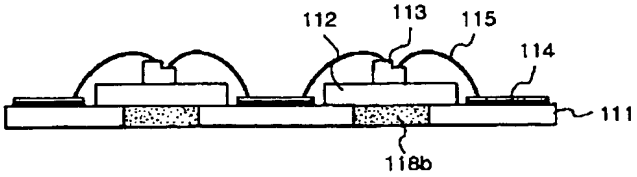


[Drawing 7]

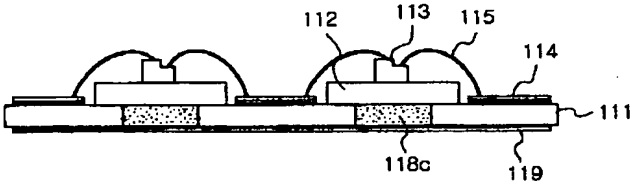
(a)



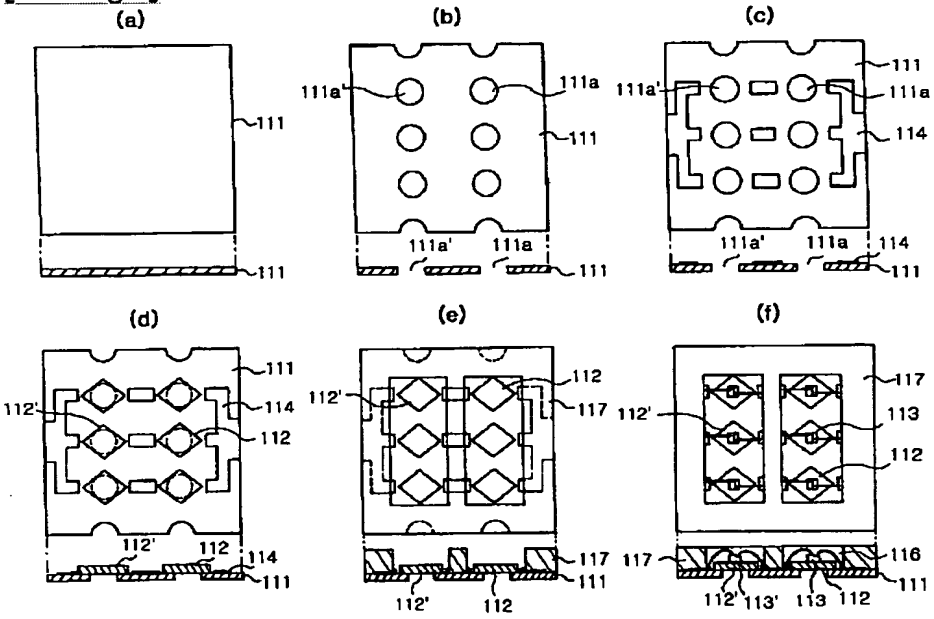
(b)



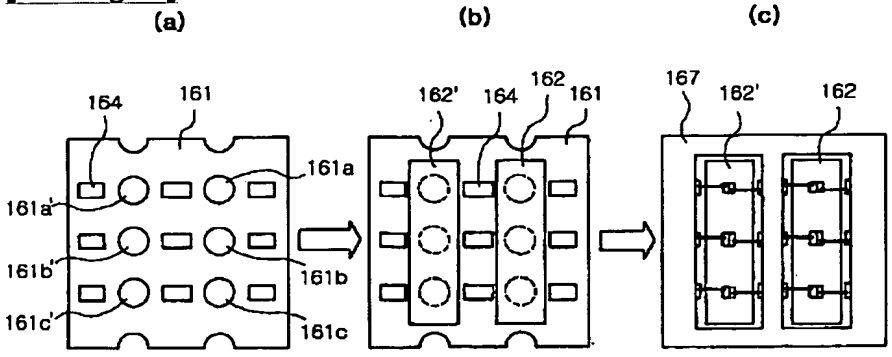
(c)



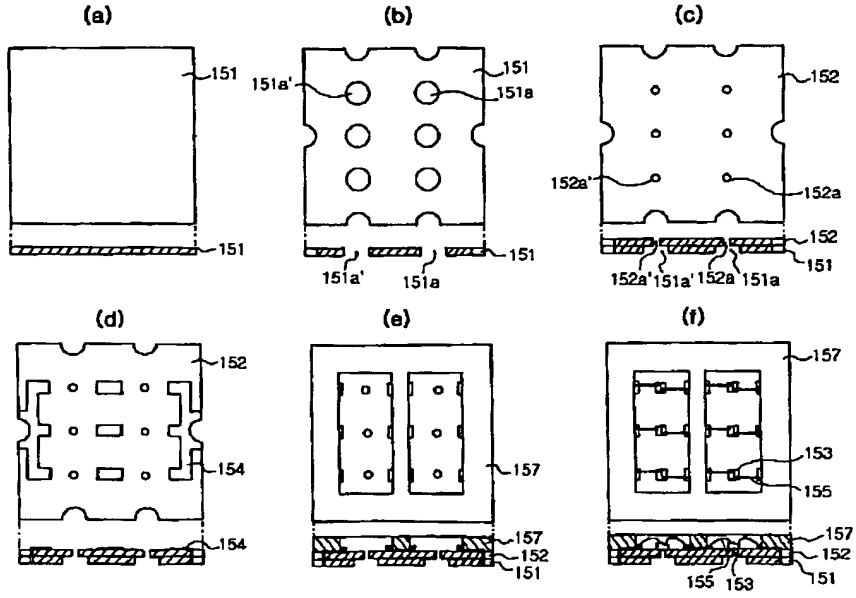
[Drawing 9]



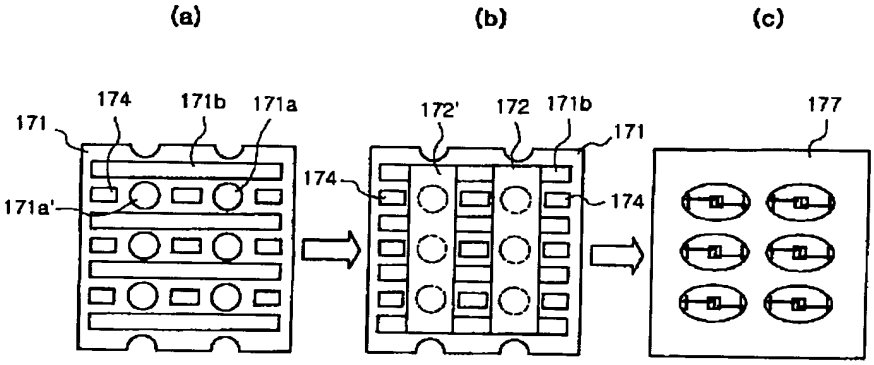
[Drawing 10]



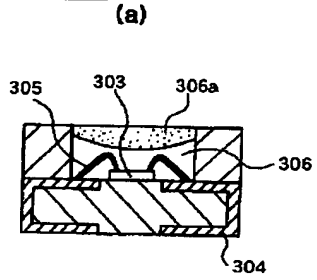
[Drawing 11]

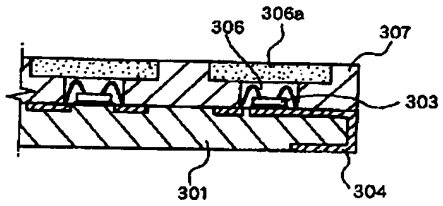


[Drawing 12]

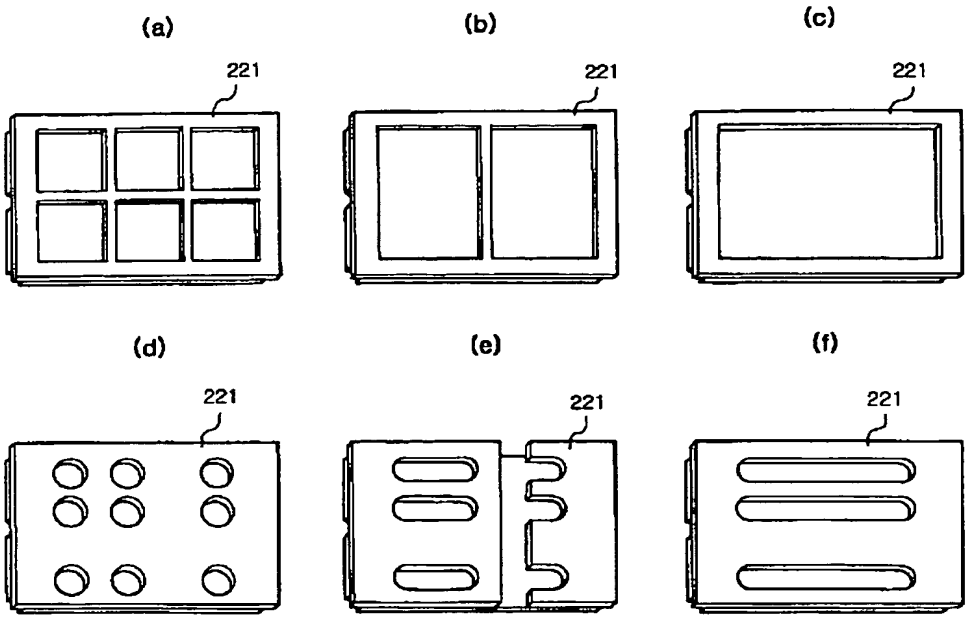


[Drawing 15]

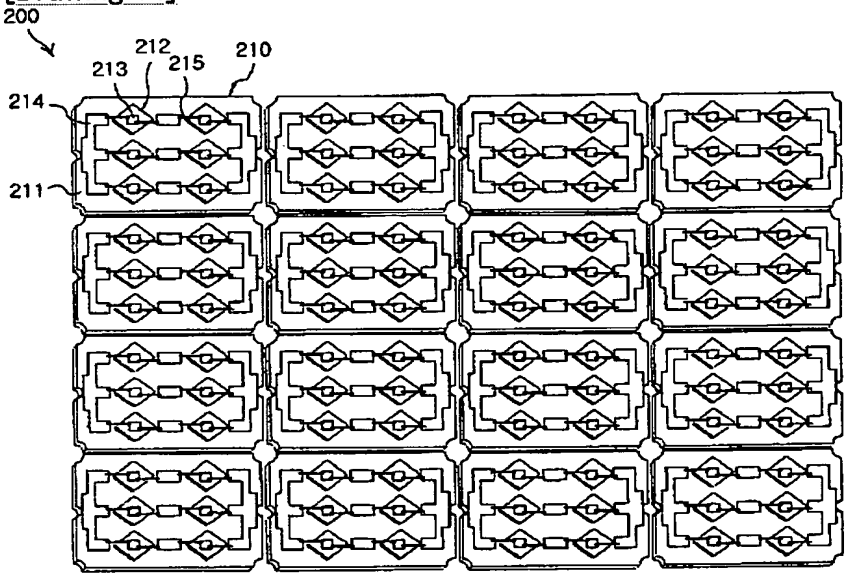




[Drawing 13]



[Drawing 14]



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号
特開2002－353515
（P2002－353515A）
(43)公開日　平成14年12月6日(2002.12.6)

(51)Int.Cl.'	識別記号	ＦＩ	ﾃｰﾏｺｰﾄﾞ(参考)
Ｈ０１Ｌ　33/00		Ｈ０１Ｌ　33/00	Ｎ　５Ｆ０４１

審査請求　有　請求項の数39　ＯＬ　（全 16 頁）

(21)出願番号　特願2001－321283(P2001－321283)
(22)出願日　平成13年10月19日(2001.10.19)
(31)優先権主張番号　２００１－２８６８５
(32)優先日　平成13年５月24日(2001.5.24)
(33)優先権主張国　韓国（ＫＲ）

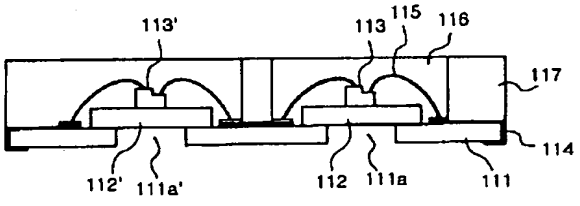
(71)出願人　591003770
三星電機株式会社
大韓民国京畿道水原市八達區梅灘３洞314番地
(72)発明者　宋　京　燮
大韓民国ソウル市城東区金湖洞１街壁山アパート305洞1208号
(72)発明者　朴　英　豪
大韓民国京畿道水原市八達区遠川洞35遠川住公アパート103洞408号
(74)代理人　100083806
弁理士　三好　秀和　（外１名）

最終頁に続く

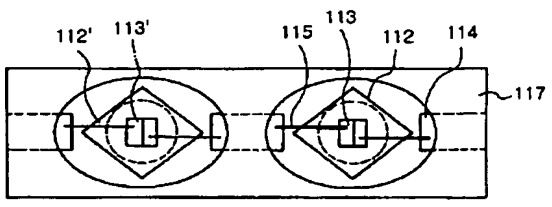
(54)【発明の名称】　発光ダイオード及びこれを用いた発光装置とその製造方法

(57)【要約】
【課題】　本発明は発光ダイオード(LED)、これを用いた発光装置及びその製造工程を提供する。
【解決手段】　本発明による発光装置は様々な放熱設計により製造される。先ず、多数個の放熱穴(holes for heat sink)１１１ａ、１１１ａ'を設けたセラミック基板１１１上に一定形態のパターン電極を設ける。セラミック基板上に補助セラミックシート１１２、１１２'を積層して各々の放熱穴を覆い、パターン電極の一部と補助セラミックシートの全部または一部とが露出されるよう上部セラミックシート１１７を積層する。前記補助セラミックシート上にはＬＥＤ素子１１３、１１３'を実装する。各電極１１４とＬＥＤ素子をワイヤー１１５によって電気的に接続し上部セラミックシート内のＬＥＤ素子を絶縁樹脂で密封する。こうして製造される発光装置は放熱特性が向上され高密度でＬＥＤ素子を大面積の基板に実装できる為に大面積のディスプレー及び次世代照明設備に大変適する。

(a)



(b)



1

【特許請求の範囲】

【請求項１】　１個の放熱穴(a hole for heat sink)を設けるセラミック基板と、

前記セラミック基板上に位置されＬＥＤ素子を実装できるよう前記放熱穴を覆う一定形態の補助セラミックシートと、

前記補助セラミックシート上で前記放熱穴を中心に一定パターンを形成する電極と、

前記電極とワイヤーにより電気的に接続され前記補助セラミックシート上に実装されるＬＥＤ素子と、

前記ＬＥＤ素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、

前記上部セラミックシート内のＬＥＤ素子を密封する絶縁層と、

を備えたことを特徴とする発光ダイオード。

【請求項２】　前記放熱穴の内側には前記補助セラミックシートとセラミック基板の接触部分に沿って金属ペーストが塗布されることを特徴とする請求項１記載の発光ダイオード。

【請求項３】　前記放熱穴の内側には金属ペーストが充填されることを特徴とする請求項１記載の発光ダイオード。

【請求項４】　前記放熱穴の内側に充填される金属ペーストの下部には前記セラミック基板に沿って金属板が付着されることを特徴とする請求項３記載の発光ダイオード。

【請求項５】　前記放熱穴の内側には金属ペーストが充填され前記セラミック基板の下部には金属ペーストが塗布されることを特徴とする請求項３記載の発光ダイオード。

【請求項６】　前記放熱穴の内側には金属塊(lump or slug)が挿入されることを特徴とする請求項１記載の発光ダイオード。

【請求項７】　前記セラミック基板及び補助セラミックシート又は当該セラミック基板若しくは補助セラミックシートはアルミナまたはＳｉＣであることを特徴とする請求項１記載の発光ダイオード。

【請求項８】　前記電極はセラミック基板側からＡｇ、Ｎｉ及びＡｕ層で成ることを特徴とする請求項１記載の発光ダイオード。

【請求項９】　前記絶縁層はエポキシまたはＳｉ系透明性樹脂であることを特徴とする請求項１記載の発光ダイオード。

【請求項１０】　前記補助セラミックシートはＬＥＤ素子の下部に１個の放熱穴を更に設けることを特徴とする請求項１記載の発光ダイオード。

【請求項１１】　１個の放熱穴を設けるセラミック基板を備える段階と、

前記セラミック基板上に補助セラミックシートを積層する段階と、

2

前記補助セラミックシート上に前記放熱穴を中心に両側に一定形態のパターン電極を設ける段階と、

前記パターン電極の一部が露出されるよう所定形状の開口部(opening)を設ける上部セラミックシートを前記セラミック基板上に積層する段階と、

前記積層されるセラミック基板を同時焼成(co-fire)する段階と、

前記補助セラミック基板のパターン電極上に電極を設けた後に放熱穴と対向する位置でＬＥＤ素子を補助セラミックシート上に実装する段階と、

前記電極とＬＥＤ素子を各々電気的に接続させた後に前記上部セラミックシート内のＬＥＤ素子を絶縁樹脂で密封する段階と、

を有することを特徴とする発光ダイオードの製造方法。

【請求項１２】　前記セラミック基板及び補助セラミックシート又は当該セラミック基板若しくは補助セラミックシートはアルミナまたはＳｉＣを用いることを特徴とする請求項１１記載の発光ダイオードの製造方法。

【請求項１３】　前記電極はセラミック基板上のＡｇペースト層にＮｉ及びＡｕ層をめっきして成ることを特徴とする請求項１１記載の発光ダイオードの製造方法。

【請求項１４】　前記絶縁樹脂はエポキシまたはＳｉ系透明性樹脂を用いて充填することを特徴とする請求項１１記載の発光ダイオードの製造方法。

【請求項１５】　前記積層されるセラミック基板は８００～１０５０℃で同時焼成されることを特徴とする請求項１１記載の発光ダイオードの製造方法。

【請求項１６】　前記放熱穴の内側には前記補助セラミックシートとセラミック基板との接触部分に沿って金属ペーストを塗布することを特徴とする請求項１１記載の発光ダイオードの製造方法。

【請求項１７】　前記放熱穴の内側には金属ペーストを充填することを特徴とする請求項１１記載の発光ダイオードの製造方法。

【請求項１８】　前記放熱穴の内側に金属ペーストを充填し前記セラミック基板の下部に金属板を付着することを特徴とする請求項１７記載の発光ダイオードの製造方法。

【請求項１９】　前記放熱穴の内側には金属ペーストを充填し前記セラミック基板の下部に金属ペーストを塗布することを特徴とする請求項１７記載の発光ダイオードの製造方法。

【請求項２０】　前記放熱穴の内側には金属塊(lump or slug)を挿入することを特徴とする請求項１１記載の発光ダイオードの製造方法。

【請求項２１】　前記補助セラミックシートには前記放熱穴より小さくＬＥＤ素子より小さい他放熱穴を更に設けることを特徴とする請求項１１記載の発光ダイオードの製造方法。

【請求項２２】　１個の放熱穴を設けて当該穴の両側に

一定形態の電極を設けるセラミック基板と、
前記セラミック基板上に位置されＬＥＤ素子を実装できるよう前記放熱穴を覆う一定形態の補助セラミックシートと、
前記電極とワイヤーにより電気的に接続され前記補助セラミックシート上に実装されるＬＥＤ素子と、
前記ＬＥＤ素子を囲みながらセラミック基板上に設けられる上部セラミックシートと、
前記上部セラミックシート内のＬＥＤ素子を密封する絶縁層と、
を備えたことを特徴とする発光ダイオード。
【請求項２３】　前記補助セラミックシートはＬＥＤ素子の下部に１個の放熱穴を更に設けることを特徴とする請求項２２記載の発光ダイオード。
【請求項２４】　１個の放熱穴を設けるセラミックシートを備えて当該セラミックシート上に一定形態のパターン電極を設けてセラミック基板を製造する段階と、
前記放熱穴を覆うよう前記セラミック基板上に一定形態の補助セラミックシートを積層する段階と、
前記パターン電極の一部と補助セラミックシートの一部または全部が露出されるよう所定形状の開口部を設ける上部セラミックシートを前記セラミック基板上に積層する段階と、
前記セラミック基板を同時焼成する段階と、
前記セラミック基板のパターン電極上に電極を設けた後に前記補助セラミックシート上にＬＥＤ素子を実装する段階と、
前記電極とＬＥＤ素子を電気的に接続させた後に前記上部セラミックシート内のＬＥＤ素子を絶縁樹脂で密封する段階と、
を有することを特徴とする発光ダイオードの製造方法。
【請求項２５】　１個の放熱穴を設けるセラミック基板と、
前記セラミック基板上に位置されＬＥＤ素子を実装できるよう前記放熱穴を覆う補助セラミックシートと、
前記補助セラミックシート上で放熱穴を中心に両側に設けられる一定形態の電極と、
前記放熱穴と対向して補助セラミックシートとＬＥＤとの間に位置し補助セラミックシート上に設けられる一定パターンの他電極と、
前記補助セラミックシート上の他電極上に実装され補助セラミック基板の電極とワイヤーにより電気的に接続されるＬＥＤ素子と、
前記ＬＥＤ素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、
前記上部セラミックシート内のＬＥＤ素子を密封する絶縁層と、を備えたことを特徴とする発光ダイオード。
【請求項２６】　多数個の放熱穴(holes for heat sink)を設けるセラミック基板と、
前記セラミック基板上に位置されＬＥＤ素子を実装できるよう前記放熱穴を覆う一定形態の補助セラミックシートと、

前記補助セラミックシート上で前記放熱穴を中心に設けられる一定パターンの電極と、
前記電極とワイヤーにより電気的に接続され前記補助セラミックシート上に実装されるＬＥＤ素子と、
前記ＬＥＤ素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、
前記上部セラミックシート内のＬＥＤ素子を密封する絶縁層と、
を備えたことを特徴とする発光ダイオードを用いた発光装置。
【請求項２７】　前記補助セラミックシートは各々のＬＥＤ素子の下部に１個の放熱穴を更に設けることを特徴とする請求項２６記載の発光装置。
【請求項２８】　多数個の放熱穴を設けるセラミック基板を備える段階と、
前記セラミック基板上に補助セラミックシートを積層する段階と、
前記補助セラミックシート上で前記放熱穴を中心に両側に一定形態のパターン電極を設ける段階と、
前記パターン電極の一部が露出されるよう所定形状の開口部を設ける上部セラミックシートを補助セラミックシート上に積層する段階と、
前記積層されるセラミック基板を同時焼成する段階と、
前記補助セラミックシートのパターン電極上に電極を設けた後に放熱穴と対向する位置でＬＥＤ素子を補助セラミックシート上に実装する段階と、
前記電極とＬＥＤ素子を各々電気的に接続させた後に前記上部セラミックシート内のＬＥＤ素子を絶縁樹脂で密封する段階と、
を有することを特徴とする発光装置の製造方法。
【請求項２９】　前記補助セラミックシートには前記放熱穴より小さくＬＥＤ素子より小さい他放熱穴を更に設けることを特徴とする請求項２８記載の発光装置の製造方法。
【請求項３０】　多数個の放熱穴を設け各穴の両側に一定形態の電極を設けるセラミック基板と、
前記セラミック基板上に位置されＬＥＤ素子を実装できるよう前記各々の放熱穴を覆う一定形態の補助セラミックシートと、
前記各電極とワイヤーにより電気的に接続され前記補助セラミックシート上に各々実装される多数個のＬＥＤ素子と、
前記ＬＥＤ素子を囲みながらセラミック基板上に設けられる上部セラミックシートと、
前記上部セラミックシート内のＬＥＤ素子を密封する絶縁層と、
を備えたことを特徴とする発光ダイオードを用いた発光装置。

【請求項３１】　前記補助セラミックシートはセラミック基板上に位置され各々１個の放熱穴を覆うよう独立した補助セラミックシートであることを特徴とする請求項３０記載の発光ダイオードを用いた発光装置。

【請求項３２】　前記補助セラミックシートはセラミック基板上に位置され各々少なくとも１個以上の放熱穴を覆うよう独立した補助セラミックシートであることを特徴とする請求項３０記載の発光ダイオードを用いた発光装置。

【請求項３３】　多数個の放熱穴を設けるセラミックシートを備え当該セラミックシート上に一定形態のパターン電極を設けてセラミック基板を製造する段階と、
前記各々の放熱穴を覆うよう前記セラミック基板上に一定形態の補助セラミックシートを積層する段階と、
前記パターン電極の一部と補助セラミックシートの一部または全部が露出されるよう所定形状の開口部を設ける上部セラミックシートをセラミック基板上に積層する段階と、
前記セラミック基板を同時焼成する段階と、
前記セラミック基板のパターン電極上に電極を設けた後に前記補助セラミックシート上にＬＥＤ素子を各々実装する段階と、
前記電極とＬＥＤ素子を各々電気的に接続させた後に前記上部セラミックシート内のＬＥＤ素子を絶縁樹脂で密封する段階と、
を有することを特徴とする発光ダイオードを用いた発光装置の製造方法。

【請求項３４】　前記セラミック基板上には各々１個の放熱穴を覆うよう独立した補助セラミックシートを積層することを特徴とする請求項３３記載の発光ダイオードを用いた発光装置の製造方法。

【請求項３５】　前記セラミック基板上には少なくとも１個以上の放熱穴を覆うよう独立した補助セラミックシートを積層することを特徴とする請求項３３記載の発光ダイオードを用いた発光装置の製造方法。

【請求項３６】　前記セラミック基板は放熱穴とは別途の放熱開口部(openings for heat sink)を更に設けることを特徴とする請求項３３記載の発光ダイオードを用いた発光装置の製造方法。

【請求項３７】　前記補助セラミックシートには各々のＬＥＤ素子の下部に１個の放熱穴を更に設けることを特徴とする請求項３３記載の発光ダイオードを用いた発光装置の製造方法。

【請求項３８】　多数個の放熱穴を設けるセラミック基板と、
前記セラミック基板上に位置されＬＥＤ素子を実装できるよう前記放熱穴を覆う補助セラミックシートと、
前記補助セラミックシート上で放熱穴を中心に両側に設けられる一定形態の電極と、
前記放熱穴と対向し前記補助セラミックシートとＬＥＤとの間に位置して補助セラミックシート上に設けられる一定パターンの他電極と、
前記補助セラミックシート上の他電極上に実装され補助セラミック基板の電極とワイヤーにより電気的に接続されるＬＥＤ素子と、
前記ＬＥＤ素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、
前記上部セラミックシート内のＬＥＤ素子を密封する絶縁層と、
を備えたことを特徴とする発光ダイオードを用いた発光装置。

【請求項３９】　請求項２６記載の発光ダイオードを用いた発光装置を多数個備えることを特徴とする大面積の発光ユニットアセンブリー。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は発光ダイオード、これを用いた発光装置及びその製造方法に関するものとして、詳しくは放熱特性に優れ大面積のディスプレイ及び照明設備に適する高密度実装用発光ダイオード及びこれを用いた発光装置とその製造方法に関するものである。

【０００２】

【従来の技術】発光ダイオード(以下、ＬＥＤという。)は固体発光表示素子(indicator)の一種である。ＬＥＤは光の３原色である赤(Ｒ)、緑(Ｇ)、青(Ｂ)を含んだ単色ＬＥＤから、より多様な分野に応用できる白色光(Ｗ)ＬＥＤが具現された。最近はランプ形態のＬＥＤから基板に実装が容易なチップ(ＳＭＤ)形態のＬＥＤに発展し大面積の高密度ＬＥＤ実装がより可能になった。これに伴ってＬＥＤの応用分野は一般表示装置からディスプレイのバックライト用発光源はもちろん、白熱電球や蛍光ランプ、街灯を代替できる次世代照明設備へと漸次その活用範囲が拡大しつつある。ＬＥＤ照明設備の場合、一般蛍光灯とは異なって点灯回路が単純でインバータ回路と鉄心安定器が不要である。更に、ＬＥＤを用いた照明設備は蛍光灯に比して電力消耗が少なく寿命が１０倍以上長い為維持や補修費を省けるという長所がある。

【０００３】前記照明設備に応用される白色ＬＥＤの代表例として、特開２０００-３１５８２６号公報にはＬＥＤと蛍光体(phosphor)とから成る発光素子が開示されている。前記特開２０００-３１５８２６号公報による発光素子は図１５（ａ）、（ｂ）に示す如く、セラミック基板３０１に実装された青色ＬＥＤ３０３、青色ＬＥＤチップ３０３を覆っている第１透明性コーティング部３０６、前記ＬＥＤチップ及び第１透明性コーティング部上に配置されて蛍光物質を含有する第２透明性コーティング部３０６ａ及び前記ＬＥＤチップとワイヤー３０５により電気的に接続された電極３０４とを含んで成る。こうした発光装置はＬＥＤチップから放たれる可視光と、該可視光を吸収し異なる可視光を放つ蛍光物質か

ら放たれる光との混合光である白色光を照射する。前記発光装置は発光効率が優れ均一な白色の混色光を誘導できる。この他にも白色光を具現できるＬＥＤは多数提案されている(米国特許第５,９９８,９２５号、第６,０６９,４４０号)。

【０００４】

【発明が解決しようとする課題】ところで、こうしたＬＥＤを用いた応用製品の特性劣化及び故障に係わる最大の原因に挙げられるものは熱的ストレス(thermal stress)である。前記提案された諸ＬＥＤチップはもちろん一般のＬＥＤチップを図１５（ｂ）の如く、直接同一基板上に高密度実装し信号灯や照明設備等に用いる場合にＬＥＤチップはより多くの熱を発散し、総発光面積に比例して放熱量が増大する傾向を呈する。特に、青色ＬＥＤの場合、他の色の高輝度ＬＥＤに比して相対的に高い駆動電圧を有する為に温度が増加する現象を見せる。その上、照明設備の面積が大きいほど、ＬＥＤチップが高密度に実装されるほど、ＬＥＤの特性劣化及び故障の発生がより甚だしいことと思われる。また、既存の発光装置は図１５（ｂ）の如き構造を有し放熱特性が良好ではなく大面積の高密度ＬＥＤチップ実装に限界がある。

【０００５】本発明は、このような従来の課題に鑑みてなされたものであり、その目的は、放熱性が優れ高密度実装に適したＬＥＤを提供することである。本発明の異なる目的は、こうしたＬＥＤを容易に製造せしめる方法を提供することである。

【０００６】本発明の更に異なる目的は、前記ＬＥＤを用いて大面積に高密度実装する場合にも放熱特性の優れた発光装置を提供することである。また、本発明の他の目的は、こうした発光装置を容易に製造せしめる方法を提供することである。そして、本発明の更に異なる他の目的は、こうした発光装置を用いた大面積の発光ユニットアセンブリー(light emitting unit assembly for large area)を提供することである。

【０００７】

【課題を解決するための手段】前記目的を成し遂げる為に、本発明によるＬＥＤは、１個の放熱穴(a hole for heat sink)を設けるセラミック基板と、前記セラミック基板上に位置されＬＥＤ素子を実装できるよう前記放熱穴を覆う一定形態の補助セラミックシートと、前記補助セラミックシート上で前記放熱穴を中心に一定パターンを形成する電極と、前記電極とワイヤーにより電気的に接続され前記補助セラミックシート上に実装されるＬＥＤ素子と、前記ＬＥＤ素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、前記上部セラミックシート内のＬＥＤ素子を密封する絶縁層とを備えたことを要旨とする。従って、放熱性が優れ高密度実装に適したものとなる。前記放熱穴の内側には前記補助セラミックシートとセラミック基板の接触部分に沿って金属ペーストが塗布されることを要旨とする。前記放熱穴の内側には金属ペーストが充填されることを要旨とする。前記放熱穴の内側に充填される金属ペーストの下部には前記セラミック基板に沿って金属板が付着されることを要旨とする。前記放熱穴の内側には金属ペーストが充填され前記セラミック基板の下部には金属ペーストが塗布されることを要旨とする。前記放熱穴の内側には金属塊(lump or slug)が挿入されることを要旨とする。前記セラミック基板及び補助セラミックシート又は当該セラミック基板若しくは補助セラミックシートはアルミナまたはＳｉＣであることを要旨とする。前記電極はセラミック基板側からＡｇ、Ｎｉ及びＡｕ層で成ることを要旨とする。前記絶縁層はエポキシまたはＳｉ系透明性樹脂であることを要旨とする。前記補助セラミックシートはＬＥＤ素子の下部に１個の放熱穴を更に設けることを要旨とする。

【０００８】また、前記目的を成し遂げる為に、本発明によるＬＥＤの製造方法は、１個の放熱穴を設けるセラミック基板を備える段階と、前記セラミック基板上に補助セラミックシートを積層する段階と、前記補助セラミックシート上に前記放熱穴を中心に両側に一定形態のパターン電極を設ける段階と、前記パターン電極の一部が露出されるよう所定形状の開口部(opening)を設ける上部セラミックシートを前記セラミック基板上に積層する段階と、前記積層されるセラミック基板を同時焼成(co-fire)する段階と、前記補助セラミック基板のパターン電極上に電極を設けた後に放熱穴と対向する位置でＬＥＤ素子を補助セラミックシート上に実装する段階と、前記電極とＬＥＤ素子を各々電気的に接続させた後に前記上部セラミックシート内のＬＥＤ素子を絶縁樹脂で密封する段階とを備えたことを要旨とする。従って、放熱性が優れ高密度実装に適したＬＥＤを容易に製造せしめる。前記セラミック基板及び補助セラミックシート又は当該セラミック基板若しくは補助セラミックシートはアルミナまたはＳｉＣを用いることを要旨とする。前記電極はセラミック基板上のＡｇペースト層にＮｉ及びＡｕ層をめっきして成ることを要旨とする。前記絶縁樹脂はエポキシまたはＳｉ系透明性樹脂を用いて充填することを要旨とする。前記積層されるセラミック基板は８００～１０５０℃で同時焼成されることを要旨とする。前記放熱穴の内側には前記補助セラミックシートとセラミック基板との接触部分に沿って金属ペーストを塗布することを要旨とする。前記放熱穴の内側には金属ペーストを充填することを要旨とする。前記放熱穴の内側に金属ペーストを充填し前記セラミック基板の下部に金属板を付着することを要旨とする。前記放熱穴の内側には金属ペーストを充填し前記セラミック基板の下部に金属ペーストを塗布することを要旨とする。前記放熱穴の内側には金属塊(lump or slug)を挿入することを要旨とする。前記補助セラミックシートには前記放熱穴より小さくＬＥＤ素子より小さい他放熱穴を更に設けることを要旨とす

る。

【０００９】更に、前記目的を成し遂げる為に、本発明によるＬＥＤは、１個の放熱穴(a hole for heat sink)を設け該穴の両側に一定形態の電極を設けたセラミック基板と、前記セラミック基板上に位置されＬＥＤ素子を実装できるよう前記放熱穴を覆う一定形態の補助セラミックシートと、前記電極とワイヤーによって電気的に接続され前記補助セラミックシート上に実装されたＬＥＤ素子と、前記ＬＥＤ素子を囲みながらセラミック基板上に設けられた上部セラミックシートと、及び前記上部セラミックシート内のＬＥＤ素子を密封している絶縁層とを含んで成る。従って、放熱性が優れ高密度実装に適したものとなる。前記補助セラミックシートはＬＥＤ素子の下部に１個の放熱穴を更に設けることを要旨とする。

【００１０】また、前記目的を成し遂げる為に、本発明によるＬＥＤの製造方法は、１個の放熱穴(a hole for heat sink)を設けたセラミックシートを備え当該セラミックシート上に一定形態のパターン電極を設けセラミック基板を製造する段階と、前記放熱穴を覆うよう前記セラミック基板上に一定形態の補助セラミックシートを積層する段階と、前記パターン電極の一部と補助セラミックシートの一部または全部が露出されるよう所定形状の開口部(opening)を設けた上部セラミックシートをセラミック基板上に積層する段階と、前記セラミック基板を同時焼成(co-fire)する段階と、前記セラミック基板のパターン電極上に電極を設けた後、前記補助セラミックシート上にＬＥＤ素子を実装する段階と、及び前記電極とＬＥＤ素子を電気的に接続させた後、前記上部セラミックシート内のＬＥＤ素子を絶縁樹脂で密封する段階とを含んで成る。従って、放熱性が優れ高密度実装に適したＬＥＤを容易に製造せしめる。

【００１１】更に、前記目的を成し遂げる為に、本発明によるＬＥＤは、１個の放熱穴を設けるセラミック基板と、前記セラミック基板上に位置されＬＥＤ素子を実装できるよう前記放熱穴を覆う補助セラミックシートと、前記補助セラミックシート上で放熱穴を中心に両側に設けられる一定形態の電極と、前記放熱穴と対向して補助セラミックシートとＬＥＤとの間に位置し補助セラミックシート上に設けられる一定パターンの他電極と、前記補助セラミックシート上の他電極上に実装され補助セラミック基板の電極とワイヤーにより電気的に接続されるＬＥＤ素子と、前記ＬＥＤ素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、前記上部セラミックシート内のＬＥＤ素子を密封する絶縁層とを備えたことを要旨とする。従って、放熱性が優れ高密度実装に適したものとなる。

【００１２】前記他の目的を成し遂げる為に、本発明によるＬＥＤを用いた発光装置は、多数個の放熱穴(holes for heat sink)を設けるセラミック基板と、前記セラミック基板上に位置されＬＥＤ素子を実装できるよう前記放熱穴を覆う一定形態の補助セラミックシートと、前記補助セラミックシート上で前記放熱穴を中心に設けられる一定パターンの電極と、前記電極とワイヤーにより電気的に接続され前記補助セラミックシート上に実装されるＬＥＤ素子と、前記ＬＥＤ素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、前記上部セラミックシート内のＬＥＤ素子を密封する絶縁層とを備えたことを要旨とする。従って、前記ＬＥＤを用いて大面積に高密度実装する場合にも放熱特性の優れたものとする。前記補助セラミックシートは各々のＬＥＤ素子の下部に１個の放熱穴を更に設けることを要旨とする。

【００１３】また、前記他の目的を成し遂げる為に、本発明によるＬＥＤを用いた発光装置の製造方法は、多数個の放熱穴を設けるセラミック基板を備える段階と、前記セラミック基板上に補助セラミックシートを積層する段階と、前記補助セラミックシート上で前記放熱穴を中心に両側に一定形態のパターン電極を設ける段階と、前記パターン電極の一部が露出されるよう所定形状の開口部を設ける上部セラミックシートを補助セラミックシート上に積層する段階と、前記積層されるセラミック基板を同時焼成する段階と、前記補助セラミックシートのパターン電極上に電極を設けた後に放熱穴と対向する位置でＬＥＤ素子を補助セラミックシート上に実装する段階と、前記電極とＬＥＤ素子を各々電気的に接続させた後に前記上部セラミックシート内のＬＥＤ素子を絶縁樹脂で密封する段階とを有することを要旨とする。従って、前記ＬＥＤを用いて大面積に高密度実装する場合にも放熱特性の優れたものとする発光装置を容易に製造せしめる。前記補助セラミックシートには前記放熱穴より小さくＬＥＤ素子より小さい他放熱穴を更に設けることを要旨とする。

【００１４】更に、前記他の目的を成し遂げる為に、本発明によるＬＥＤを用いた発光装置は、多数個の放熱穴(holes for heat sink)を設け各穴の両側に一定形態の電極を設けたセラミック基板と、前記セラミック基板上に位置されＬＥＤ素子を実装できるよう前記各放熱穴を覆う一定形態の補助セラミックシートと、前記各電極とワイヤーによって電気的に接続され前記補助セラミックシート上に各々実装された多数個のＬＥＤ素子と、前記多数個のＬＥＤ素子を囲みながらセラミック基板上に設けられた上部セラミックシートと、及び前記上部セラミックシート内のＬＥＤ素子を密封する絶縁層とを含んで成る。従って、前記ＬＥＤを用いて大面積に高密度実装する場合にも放熱特性の優れたものとする。前記補助セラミックシートはセラミック基板上に位置され各々１個の放熱穴を覆うよう独立した補助セラミックシートであることを要旨とする。前記補助セラミックシートはセラミック基板上に位置され各々少なくとも１個以上の放熱穴を覆うよう独立した補助セラミックシートであること

を要旨とする。

【００１５】また、前記他の目的を成し遂げる為に、本発明によるＬＥＤを用いた発光装置の製造方法は、多数個の放熱穴を設けたセラミックシートを備え当該セラミックシート上に一定形態のパターン電極を設けてセラミック基板を製造する段階と、前記各放熱穴を覆うよう前記セラミック基板上に一定形態の補助セラミックシートを積層する段階と、前記パターン電極の一部と補助セラミックシートの一部または全部が露出されるよう所定形状の開口部を設けた上部セラミックシートをセラミック基板上に積層する段階と、前記セラミック基板を同時焼成する段階と、前記セラミック基板のパターン電極上に電極を設けた後、前記補助セラミックシート上に多数個のＬＥＤ素子を各々実装する段階と、前記電極とＬＥＤ素子を各々電気的に接続させた後、前記上部セラミックシート内のＬＥＤ素子を絶縁樹脂で密封する段階とを含んで成る。従って、前記ＬＥＤを用いて大面積に高密度実装する場合にも放熱特性の優れたものとする発光装置を容易に製造せしめる。前記セラミック基板上には各々１個の放熱穴を覆うよう独立した補助セラミックシートを積層することを要旨とする。前記セラミック基板上には少なくとも１個以上の放熱穴を覆うよう独立した補助セラミックシートを積層することを要旨とする。前記セラミック基板は放熱穴とは別途の放熱開口部(openings for heat sink)を更に設けることを要旨とする。前記補助セラミックシートには各々のＬＥＤ素子の下部に１個の放熱穴を更に設けることを要旨とする。

【００１６】更に、前記目的を成し遂げる為に、本発明によるＬＥＤを用いた発光装置は、多数個の放熱穴を設けるセラミック基板と、前記セラミック基板上に位置されＬＥＤ素子を実装できるよう前記放熱穴を覆う補助セラミックシートと、前記補助セラミックシート上で放熱穴を中心に両側に設けられる一定形態の電極と、前記放熱穴と対向し前記補助セラミックシートとＬＥＤとの間に位置して補助セラミックシート上に設けられる一定パターンの他電極と、前記補助セラミックシート上の他電極上に実装され補助セラミック基板の電極とワイヤーにより電気的に接続されるＬＥＤ素子と、前記ＬＥＤ素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、前記上部セラミックシート内のＬＥＤ素子を密封する絶縁層とを備えたことを要旨とする。従って、前記ＬＥＤを用いて大面積に高密度実装する場合にも放熱特性の優れたものとする。

【００１７】前記更に他の目的を成し遂げる為に、本発明によるＬＥＤを用いた発光ユニットアセンブリー発光装置は、請求項２６記載の発光ダイオードを用いた発光装置を多数個備えることを要旨とする。従って、大面積の発光ユニットアセンブリーを実現できる。

【００１８】

【発明の実施の形態】以下、本発明を詳細に説明する。

本発明は多様な放熱設計によりＬＥＤ及びこれを用いた発光装置の熱的ストレスを最小化したものである。これに伴って、本発明はＬＥＤ特性を向上させ次世代照明設備の発光源として大変有用なものとなる。

【００１９】（ＬＥＤ及びその製造方法）図１は本発明によるＬＥＤの一例を示す。図１（ａ）は本発明の一実施の形態であるＬＥＤの断面構成図で、図１（ｂ）はその平面図である。本発明によるＬＥＤは図１（ａ）、（ｂ）に示す如く、大別するとセラミック基板１１、前記セラミック基板１１上に積層された補助セラミックシート１２、上部セラミックシート１６、発光素子１３及び電極１４を含んでから成る。

【００２０】本実施の形態において前記セラミック基板１１は１個の放熱穴１１ａを備える。更に、セラミック基板１１の表面上には前記放熱穴１１ａの両側に一定形態のパターン電極を設ける。 前記放熱穴はＬＥＤ素子の下部に配置されＬＥＤ素子から発生した熱を直接空中に放出しＬＥＤの熱的ストレスを最小化するのに大変適している。もちろん放熱穴は必ずしも円形の必要はなく四角または多角形等如何なる形状でも構わない。前記セラミック基板はＬＥＤ素子を高密度実装できる基板であれば如何なるものでも構わない。例えば、こうしたセラミック基板としてアルミナ(alumina)、水晶(quartz)、カルシウムジルコネート(calcium zirconate)、橄欖石(forsterite)、ＳｉＣ、黒鉛、熔融シリカ(fused silica)、ムライト(mullite)、菫青石(cordierite)、ジルコニア(zirconia)、ベリリア(beryllia)及び窒化アルミニウム(aluminum nitride)等を挙げることができる。 従って、セラミック基板の材質は特別限定されないが中でもアルミナまたはＳｉＣ材質が適している。より好ましくはアルミナを用いることである。アルミナセラミックは電気絶縁性および熱伝導率が高い。 更に、アルミナセラミックは耐熱性、耐化学性及び機械的強度が優れており、特に放射線放出が少ないという長所を有する。更に、アルミナセラミックはその上に金属導体配線パターンを設け焼成工程により積層型セラミックパッケージ(multi-layer ceramic package; MLP)として用いることができる。こうしたパッケージとして用いられる場合、気密性が優れている。

【００２１】前記補助セラミックシート１２は前記セラミック基板上に位置されＬＥＤ素子を実装できるよう前記放熱穴を覆う。補助セラミックシート１２も前記と同様にアルミナまたはＳｉＣ材質を用いるのが最も適している。前記補助セラミックシートはその形態や形状に拘わらず多様に構成され得る。図１（ｂ）では単に四角または菱形で示されているが、以後多様に提示される如く、様々な形態から成り得る。発光素子のＬＥＤ１３は前記補助セラミックシート上に実装されセラミック基板上に設けられた電極１４とワイヤー１５やその他配線パターン等によって電気的に接続される。本発明によるＬ

ＥＤはＬＥＤ素子の形態や種類に拘わらず適用できる。従って、ＲＧＢ ＬＥＤはもちろん白色光ＬＥＤのみならず多様な色相のＬＥＤ素子にも適用し得ることは言うまでもない。ＬＥＤ素子はセラミック基板の周囲に沿ってセラミック基板上に設けられた上部セラミックシート１７により囲まれて絶縁層１６により密封される。

【００２２】前記絶縁層１６は外部の物理的・化学的侵蝕からＬＥＤ素子を保護し、ＬＥＤ素子から照射される光を通過させるよう透明材質から成る。好ましき絶縁層の材質としてはエポキシまたはＳｉ系透明性樹脂等を挙げることができる。

【００２３】図２（ａ）、（ｂ）は本発明によるＬＥＤの異なる実施の形態を示す。図２（ａ）、（ｂ）の各種ＬＥＤにおいて各符合は理解し易いよう図１（ａ）、（ｂ）に対応している。先ず、図２（ａ）はＬＥＤ素子２３が実装された前記補助セラミックシート２２に他放熱穴２２ａが設けられたＬＥＤを示す。前記他放熱穴２２ａはＬＥＤ素子２３より小さいことは当然である。更に、セラミック基板２１の放熱穴２１ａより小さく設けるのが好ましい。図２（ａ）のＬＥＤはＬＥＤ素子２３が直接空気と接触する為に図１に示すＬＥＤに比して放熱特性が優れることが予測される。

【００２４】図２（ｂ）には本発明の更に異なる実施の形態のＬＥＤを例示する。図２（ａ）に示すＬＥＤとは異なって、補助セラミックシート３２がセラミック基板３１全体に亙って積層された構造から成る。更に、電極３４もセラミック基板でない補助セラミックシート３２に位置する。 こうした構造から成るＬＥＤは以後に説明する如く製造工程において大きな利点を有する。

【００２５】更に、図２（ｃ）に例示するＬＥＤは図２（ｂ）のＬＥＤ構造において補助セラミックシート４２に１個の放熱穴４２ａを更に設けている。 図２（ｃ）に例示するＬＥＤは図２（ａ）と図２（ｂ）に例示したＬＥＤの長所を全て備えている。即ち、ＬＥＤから発生した熱の放出が容易なばかりでなく製造工程においても大きな利点を有する。

【００２６】以上例示したＬＥＤは、ＬＥＤ素子として窒化物化合物を用いた青色または白色光ＬＥＤ素子の使用にあたって適した電極を有する場合に該当する。しかし、他の半導体化合物、即ちＧａＡｓ、ＧａＰ、ＳｉＣ、ＺｎＳｅ等から成るＬＥＤ素子の場合は基板自体の電気伝導度に因り電界印加方式がＬＥＤ素子の上・下部により行われる。従って、この場合のＬＥＤ素子は下方に下部電極が設けられる。図２（ｄ）にはこうしたＬＥＤ素子に適するＬＥＤの一例を示している。図２（ｄ）に例示するＬＥＤは先に例示したＬＥＤとは電極構造が大きく異なる。従って、補助セラミックシート５２上に実装されたＬＥＤ素子５３は下部の他電極５４ａがワイヤー５５等により電極５４と電気的に接続され得る。この場合、セラミック基板５１に放熱穴５１ａを設けているが補助セラミックシートにも放熱穴を設けることができる。

【００２７】以上説明したＬＥＤは多様な放熱設計により効果的にＬＥＤの熱的ストレスを抑えることができるが、各々のＬＥＤは放熱穴に導電性材料を塗布したり充填する方法でより効果的に放熱特性を増進させ得る。図３には図１のＬＥＤに適用された方式を例示する。その一方式として図３（ａ）は放熱穴１１ａの内側に補助セラミックシート１２とセラミック基板１１との接触面に沿って金属ペースト１８ａが塗布されたＬＥＤを示す。更に、図３（ｂ）は前記放熱穴１１ａの内側に金属ペースト１８ｂが充填されたＬＥＤを例示する。更に、図３（ｃ）は放熱穴１１ａの内側に金属ペーストが充填された図３（ｂ）のＬＥＤの下部にセラミック基板１１に沿って金属板１９が付着されたＬＥＤである。図３（ｄ）は放熱穴１１ａの内側に金属塊(lump or slug)１８ｄが挿入されて金属ペーストで接着されたＬＥＤを示す。図３（ｅ）に示したＬＥＤは放熱穴１１ａの内側に金属ペーストが充填された上にセラミック基板１１の下部に沿って全て金属ペースト１８ｅが塗布された構造である。これらＬＥＤは全て放熱穴１１ａにより熱放出がより容易に行う為に放熱穴だけ設ける場合に比して放熱特性が優れている。こうした構造はもちろん図１に例示したＬＥＤのみならず多様に放熱設計された図２のＬＥＤにも同一に適用し得ることは言うまでもない。

【００２８】こうした多様な放熱構造を有するＬＥＤは次の如き工程を経て製造される。即ち、例えば、図１のＬＥＤの製造方法は、先ず１個の放熱穴１１ａを設けたセラミックシート１１を備える。前記セラミックシートの放熱穴はパンチングにより簡単に設けることができる。次いで、セラミックシート上にはスクリーン印刷方式等により一定形態のパターン電極１４を設ける。前記パターン電極は設計により多様に変更し得ることは言うまでもない。本発明においてはパターン電極としてＡｇ含有ペーストが適する。前記セラミック基板は１個または２個以上のセラミックシートを積層して構成することができる。更に、セラミック基板には必要により他の配線パターンを設けることができる。前記セラミック基板を備えた後には前記放熱穴を覆うことのできる一定形態の補助セラミックシート１２を積層する。図２（ｂ）に例示されたＬＥＤの場合、補助セラミックシート３２をセラミック基板３１と同一の大きさにすればよい。

【００２９】次いで、前記パターン電極の一部と補助セラミックシートの一部または全部が露出されるよう所定形状の開口部(opening)が設けられた上部セラミックシート１７を備え、これをセラミック基板上に積層する。その後、前記セラミック基板は同時焼成を行う。この際、同時焼成は約８００～１０５０℃で行うことが好ましい。

【００３０】続いて、前記セラミック基板のパターン電

極上にめっきにより電極を設ける。本発明において電極はセラミック基板上のＡｇベースト層にＮｉ及びＡｕを順次にめっきすることが好ましい。前記電極を設けた後には補助セラミックシート１２上に設けられたＬＥＤ素子１３を実装する。その後、前記電極とＬＥＤ素子とをワイヤー１５により電気的に接続させてから、前記上部セラミックシート１７内のＬＥＤ素子１３を絶縁樹脂で密封する。

【００３１】（発光装置及びその製造方法）一方、本発明は前記の多様な放熱設計により得られる基本的な単位発光素子であるＬＥＤを用いて熱的ストレスが大幅に低減される発光装置を提供する。本発明の発光装置は、前記単品のＬＥＤを１個のＰＣＢ基板に実装せず、ＬＥＤ素子を一体化したパッケージ内で連続する金属パターン電極上に実装したものである。

【００３２】図４は本発明のＬＥＤを用いた発光装置の一例を示す。図４（ａ）は本発明の一実施の形態である発光装置の断面構成で、図４（ｂ）はその平面図である。本発明による発光装置は図４に示す如く、大別してセラミック基板１１１、前記セラミック基板上に積層された補助セラミックシート１１２、１１２'、上部セラミックシート１１６、発光素子１１３、１１３' 及び電極１１４を含んで成る。こうした発光装置は図１の多数のＬＥＤを組合せた如き構造を有する。

【００３３】具体的に、本実施の形態において前記セラミック基板１１１は多数個の放熱穴１１１ａ、１１１ａ'を設けている。 更に、セラミック基板１１１の表面上には前記放熱穴１１１ａ、１１１ａ'の両側に一定形態のパターン電極が設けられている。前述のとおり、前記放熱穴はＬＥＤ素子の下部に配置されＬＥＤ素子から発生した熱を直接空中に放出してＬＥＤの熱的ストレスを最小化するのに大変適している。もちろん放熱穴は如何なる形状でも構わない。セラミック基板はＬＥＤ素子を高密度実装し得る基板であれば如何なるものでもよい。セラミック基板の材質は前述のとおり、特別限定されはしないが中でもアルミナまたはＳｉＣ材質が適当である。より好ましくはアルミナを用いることである。

【００３４】前記補助セラミックシート１１２、１１２'は前記セラミック基板上に位置され各々のＬＥＤ素子を実装できるよう前記放熱穴を覆っている。補助セラミックシート１１２、１１２'も前記と同様にアルミナまたはＳｉＣ材質を用いることが最も適する。前記補助セラミックシートはその形態や形状に拘わらず多様に構成することができる。図１（ｂ）においては単に四角または菱形から成っているが、以後に多様に提示する如く、様々な形態から成ることができる。更に、図４（ａ）において補助セラミックシートはセラミック基板１１１上に位置され各々１個の放熱穴１１１ａを覆う独立した補助セラミックシートや、各々少なくとも１個以上の放熱穴を覆うよう独立した補助セラミックシートである(図２（ｂ）、図２（ｃ）、図１１（ｂ）及び図１２（ｂ）参照)。

【００３５】発光素子であるＬＥＤ１１３、１１３'は前記補助セラミックシート上に実装され、セラミック基板上に設けられた電極１１４とワイヤー１１５やその他配線パターン等により電気的に接続される。本発明による発光装置に実装されるＬＥＤはＬＥＤ素子の形態や種類に拘わらず適用可能である。従って、ＲＧＢ ＬＥＤはもちろん白色光ＬＥＤのみならず多様な色相のＬＥＤ素子にも適用し得ることは言うまでもない。 ＬＥＤ素子はセラミック基板の周囲に沿ってセラミック基板上に設けられた上部セラミックシート１１７により囲まれ絶縁層１１６で密封される。 前記絶縁層１１６はエポキシまたはＳｉ系透明性樹脂等から成ることが好ましい。

【００３６】図５は本発明による発光装置の異なる実施の形態を示す。図５の各種発光装置において各符合は理解し易いよう図４に対応している。先ず、図５（ａ）はＬＥＤ素子１２３、１２３'が実装された前記補助セラミックシート１２２、１２２'に他放熱穴１２２ａ、１２２ａ'が設けられた発光装置を示す。こうした発光装置は図２（ａ）の多くのＬＥＤを組合せた如き構造を有する。図５（ａ）による発光装置において放熱穴１２２ａ、１２２ａ'はＬＥＤ素子１２３、１２３'より小さいことは言うまでもない。更に、セラミック基板１２１の放熱穴１２１ａ、１２１ａ'よりは小さく形成することが好ましい。図５（ａ）による発光装置はＬＥＤ素子１２３、１２３'が直接空気と接触する為、図４に示した発光装置に比して放熱特性が優れることが予測される。

【００３７】図５（ｂ）には本発明の更に異なる実施の形態の発光装置を例示する。図５（ｂ）に示す発光装置は図４に例示された発光装置とは異なって、補助セラミックシート１３２がセラミック基板１３１全体に亙って積層される構造を有する。更に、電極１３４もセラミック基板ではなく補助セラミックシート１３２に位置する。こうした発光装置は図２（ｂ）に例示した多数のＬＥＤを組合せた構造を有し、以後の製造過程に示す如く大きな利点を有する。

【００３８】更に、図６（ａ）に例示する発光装置は図５（ｂ）の発光装置の構造において補助セラミックシート１４２に１個の放熱穴１４２ａ、１４２ａ'を更に設けている。こうした発光装置は図２（ｃ）に例示した多数のＬＥＤを組合せた構造を有する。

【００３９】図６（ｂ）に示した発光装置は図２（ｂ）に例示した多数のＬＥＤ素子を組合せた構造に適する場合を示している。即ち、こうした発光装置は図２（ｄ）に例示した多数のＬＥＤ素子を組合せた構造を有するものとして、基板自体の電気伝導度により電界印加方式がＬＥＤ素子の上・下部により行われる。前記発光装置は補助セラミックシート１５２、１５２'上に実装されたＬＥＤ素子１５３、１５３'の下部に位置する他電極１

５４ａ、１５４'がワイヤー１５５、１５５'等により電極１５４、１５４'と電気的に接続される。この場合にセラミック基板１５１に放熱穴１５１ａを設けているが、補助セラミックシート上にも更に放熱穴を設けることができる。

【００４０】以上説明した発光装置は多様な放熱設計により効果的にＬＥＤの熱的ストレスを抑えることができるが、各々の発光装置は放熱穴に導電性材料を塗布したり充填する方法でより効果的に放熱特性を増進することができる。図７には図４の発光装置に適用された方式を例示している。その一方式として図７（ａ）は放熱穴１１１ａの内側に補助セラミックシート１１２とセラミック基板１１１との接触面に沿って金属ペースト１１８ａが塗布された発光装置を示す。更に、図７（ｂ）は前記放熱穴１１１ａの内側に金属ペースト１１８ｂが充填された発光装置を例示している。更に、図７（ｃ）は放熱穴１１１ａの内側に金属ペーストが充填された図７（ｂ）の発光装置においてＬＥＤの下部にセラミック基板１１１に沿って金属板１１９が付着された発光装置である。図８（ａ）は放熱穴１１１ａの内側に金属塊(lump or slug)１１８ｄが挿入され金属ペーストで接着された発光装置を示す。図８（ｂ）に例示する発光装置は放熱穴１１１ａの内側に金属ペーストが充填された上にセラミック基板１１１の下部に沿って全て金属ペースト１１８ｅが塗布された構造である。これらの発光装置は全て放熱穴１１１ａにより熱放出をより容易に行い放熱穴だけ設けられた場合に比して放熱特性が優れている。こうした構造はもちろん図４に例示した発光装置のみならず多様に放熱設計された図５，６の発光装置にも同一に適用し得ることは言うまでもない。

【００４１】こうした多様な放熱構造を有する発光装置の製造工程は基本的に単品のＬＥＤ製造工程と類似するのがより多様である。図４に例示された発光装置における本発明の製造方法を図９に基づいて説明すれば次のとおりである。図９（ａ）と図９（ｂ）に示す如く、先ずパンチング工程により多数個の放熱穴１１１ａ、１１１ａ'を設けたセラミックシートを備える。該セラミックシート上には図９（ｃ）の如くスクリーン印刷方式等により一定形態のパターン電極１１４を設ける。前記パターン電極１１４は設計により多様に変更し得ることは言うまでもない。本発明においてはパターン電極としてＡｇ含有ペーストが適する。セラミック基板は１個または２個以上のセラミックシートを積層して構成することができる。更に、セラミック基板には必要によって他の配線パターンを設けることができる。前記セラミック基板を備えた後には、図９（ｄ）の如く前記放熱穴を覆うことのできる一定形態の補助セラミックシート１１２、１１２'を積層する。前記補助セラミックシートは前記セラミック基板上に各々１個の放熱穴を覆うよう設けることができるが、少なくとも1個以上の放熱穴を覆うよう独立した補助セラミックシートから構成することもできる。図１０はそうした一例を示している。図１０（ａ）ないし図１０（ｃ）に示す放熱装置の製造工程においては、セラミック基板１６１の一連の放熱穴１６１ａ、１６１ｂ、１６１ｃを共に覆うことのできる独立した補助セラミックシート１６２をセラミック基板１６１上に積層した後、上部セラミックシート１６７を積層する過程を示す。更に、前記補助セラミックシートは各々ＬＥＤ素子の下部に1個の放熱穴を更に設けるよう構成することもできる(図５（ａ）参照)。

【００４２】次いで、図９（ｅ）の如く、前記パターン電極の一部と補助セラミックシートの一部または全部が露出するよう所定形状の開口部を設けた上部セラミックシート１１７を備え、前記セラミック基板上に積層する。その後、前記セラミック基板は同時焼成を行う。この際、同時焼成は約８００～１０５０℃で行うことが好ましい。続いて、図９（ｆ）の如く、前記セラミック基板のパターン電極上にめっきにより電極を設ける。本発明において電極はセラミック基板上のＡｇペースト層にＮｉ及びＡｕを順次にめっきすることが好ましい。前記電極を設けた後には補助セラミックシート１１２、１１２'上に備えたＬＥＤ素子１１３、１１３'を実装する。その後、前記電極１１４とＬＥＤ素子とをワイヤーにより電気的に接続させてから、前記上部セラミックシート１１７内のＬＥＤ素子１１３、１１３'を絶縁樹脂で密封する。

【００４３】図１１は本発明による発光装置の更に異なる製造工程を示す。こうした製造工程を経て得られる発光装置は図６（ａ）の如き構造を有するであろう。図１１に示した製造工程は図９の製造工程とは異なって、１個の補助セラミックシート１５２を用いてもよいという利点があり実際に製造工程が大幅に単純化され得る。図１１に提案した発光装置の製造方法は放熱穴１５１ａ、１５１ａ'を設けたセラミック基板１５１上にパターン電極が設けられず、補助セラミックシート１５２上に設けられる。即ち、パンチング過程により前記放熱穴１５１ａ、１５１ａ'より小さく且つＬＥＤ素子より小さい他放熱穴１５２ａ、１５２ａ'を設けた補助セラミックシートを備え、前記セラミック基板上に放熱穴の中心線が一致するよう積層した後(図１１（ｃ))、補助セラミックシート上に一定形態のパターン電極１５４を設ける(図１１（ｄ))。以後の製造工程は図９と同一である。

【００４４】本発明による発光装置の製造工程はこれに限らず前記セラミック基板の放熱穴とは別途の放熱開口部(openings for heat sink)を設けることもできる。図１２はそうした例を示す。図１２にはセラミック基板１７１を製造する際に放熱穴１７１ａ、１７１ａ'とは別途に前記放熱穴の周囲に放熱開口部の如き別途の放熱手段をパンチングにより打ち抜いた過程を示す。こうした構造を有する発光装置はＬＥＤ素子から発生した熱をよ

り広い面積に至って空中に放熱できる為、多数の発光装置を用い高密度で発光ユニットアセンブリーを組合せることができ、更に発光ユニットアセンブリーの発光面をより大面積に構成できるという利点を有する。

【００４５】本発明の製造方法において上部セラミックシート１７７は多様な形態から成ることができる。上部セラミックシートはユーザーまたは使用条件等の外部環境に合わせて多様な形状に設計することができる。図１３は上部セラミックシートの多様な形状を例示している。図１３に示す前記上部セラミックシートの開口部または窓(windows)にはＬＥＤ数を適切に配置して発光面の面積と形態を効率的に決定し得る。

【００４６】（発光ユニットアセンブリー）本発明においてはこれまで説明した発光装置を少なくとも１個以上配置して大面積の発光ユニットアセンブリーを構成することができる。図１４はそうした発光ユニットのアセンブリーの一例として、理解が容易なように図面において上部セラミックシートは略した。本発明による発光ユニットアセンブリーは発光ユニット２１０を適切に配置して成る。更に、発光ユニットアセンブリーでは上部に積層される上部セラミックシートをパンチングにより形状と形態を適切に形成し発光面積及び発光面の形状を調節できるので、ＬＥＤ素子から照射される光の量も調節し得る。特に、本発明の発光ユニットアセンブリーは多様な放熱設計ができＬＥＤ素子から発生する熱の放出が容易なので、ＬＥＤ素子を高密度大面積に設計することができる。

【００４７】

【発明の効果】上述の如く、本発明によるＬＥＤは多様な放熱設計によりＬＥＤ素子から発生する熱の放出を効率的に行いＬＥＤ素子の熱的ストレスを最小化にできてＬＥＤ素子の安定的な動作を行える。更に、本発明は高密度でＬＥＤ素子を大面積基板に実装し得る発光装置を提供する。こうした発光装置は多様な色相(full color)を呈するディスプレー等の発光源のみならず白熱電球や蛍光灯、街灯を代替し得る次世代照明設備に大変適する。

【図面の簡単な説明】

【図１】本発明による発光ダイオードの構成図である。

【図２】本発明による異なる発光ダイオードの断面図である。

【図３】本発明による更に異なる発光ダイオードの断面図である。

【図４】本発明による発光装置の構成図である。

【図５】本発明による異なる発光装置の断面図である。

【図６】本発明による異なる発光装置の断面図である。

【図７】本発明による更に異なる発光装置の断面図である。

【図８】本発明による更に異なる発光装置の断面図である。

【図９】本発明による発光装置の製造工程図を例示するものである。

【図１０】本発明による発光装置の異なる製造工程の一部である。

【図１１】本発明による発光装置の更に異なる製造工程図を例示するものである。

【図１２】本発明による発光装置の更に異なる製造工程の一部である。

【図１３】本発明による発光装置の上部セラミックシートの例示図である。

【図１４】本発明による発光素子を用いた大面積発光装置の構成図である。

【図１５】（ａ）は従来の発光素子の断面図であり、（ｂ）は（ａ）の発光素子を用いた発光装置の断面図である。

【符号の説明】

１１１、１２１、１３１、１４１、１５１、１６１、１７１　セラミック基板

１１１ａ、１２１ａ、１３１ａ、１４１ａ、１５１ａ、１６１ａ、１７１ａ放熱穴

１１２、１２２、１３２、１４２、１５２、１６２、１７２　補助セラミックシート

１１３、１２３、１３３、１４３、１５３、１６３、１７３　発光ダイオード

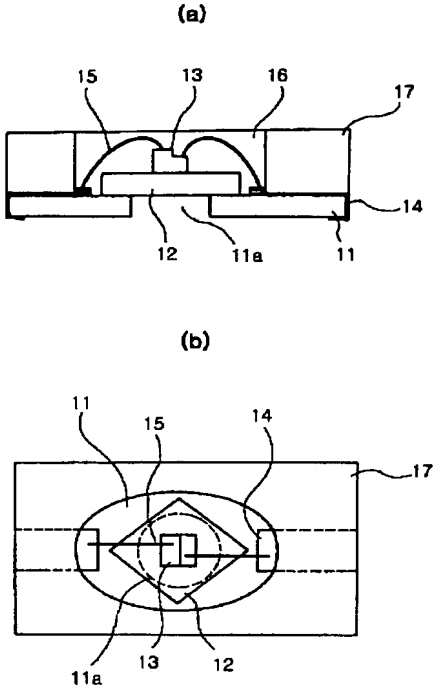
１１４、１２４、１３４、１４４、１５４、１６４、１７４　電極

１１５、１２５、１３５、１４５、１５５、１６５、１７５　ワイヤー

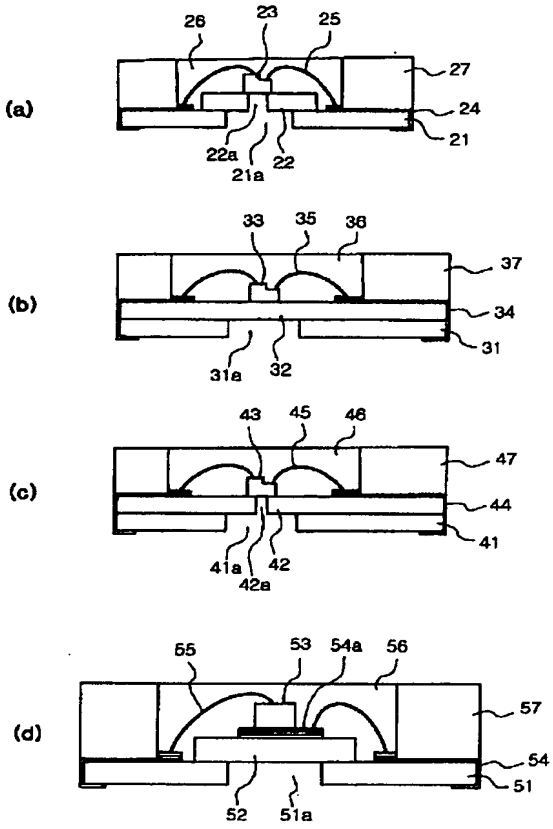
１１６、１２６、１３６、１４６、１５６、１６６、１７６　絶縁層

１１７、１２７、１３７、１４７、１５７、１６７、１７７　上部セラミックシート

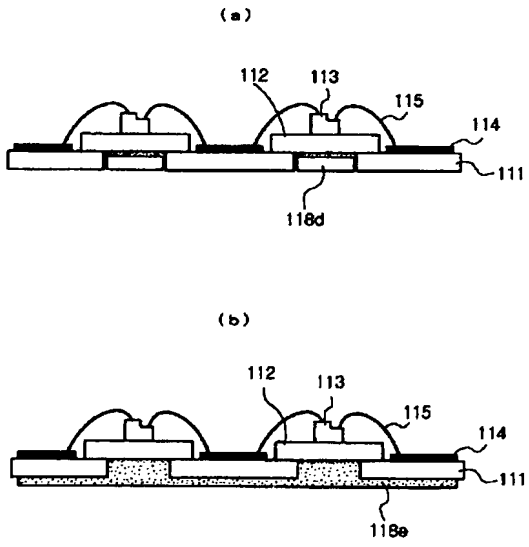
【図１】


(a)
15
13
16
17
14
12
11a
11
(b)
11
15
14
17
11a
13
12

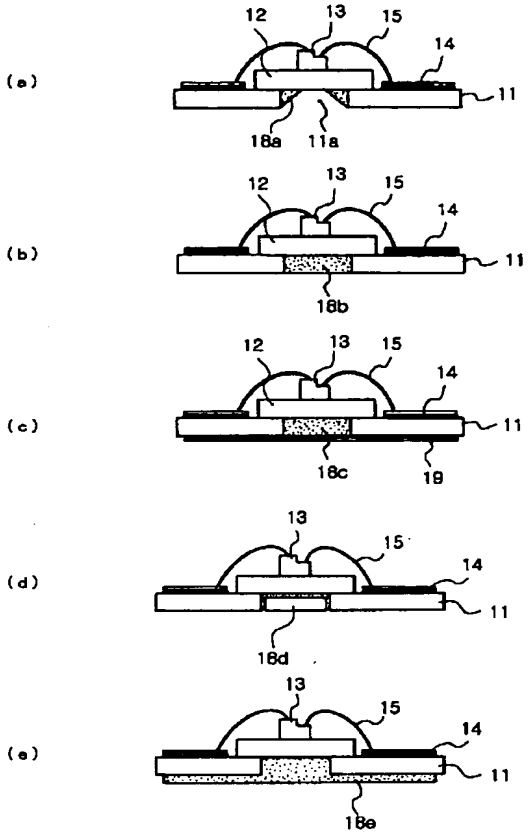
【図２】


(a)
26
23
25
27
24
21
22a
21a
22
(b)
33
35
36
37
34
31
31a
32
(c)
43
45
46
47
44
41
41a
42
42a
(d)
55
53
54a
56
57
54
51
52
51a

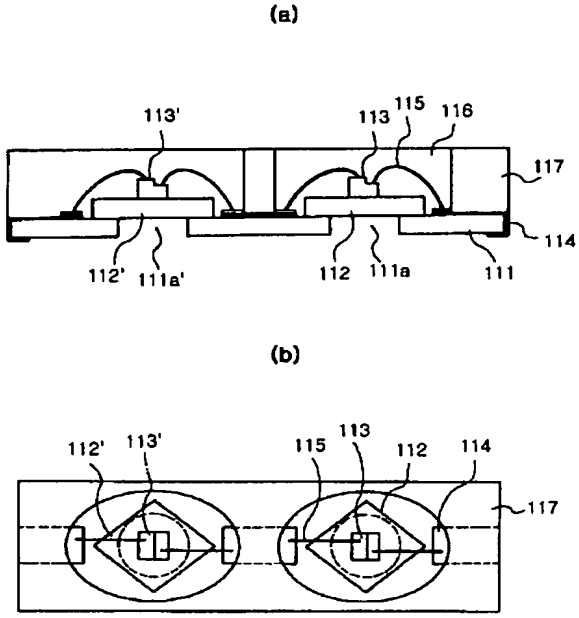
【図８】


(a)
112
113
115
114
111
118d
(b)
112
113
115
114
111
118e

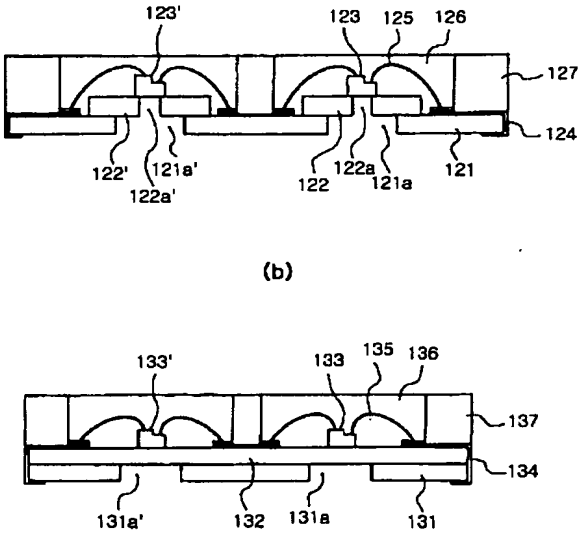
【図３】


(a)
12
13
15
14
11
18a
11a
(b)
12
13
15
14
11
18b
(c)
12
13
15
14
11
18c
19
(d)
13
15
14
11
18d
(e)
13
15
14
11
18e

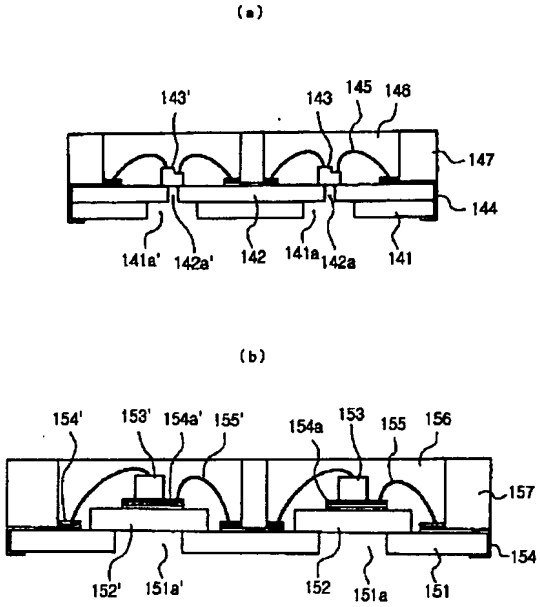
【図４】


(a)
113'
113
115
116
117
114
112'
111a'
112
111a
111
(b)
112'
113'
115
113
112
114
117

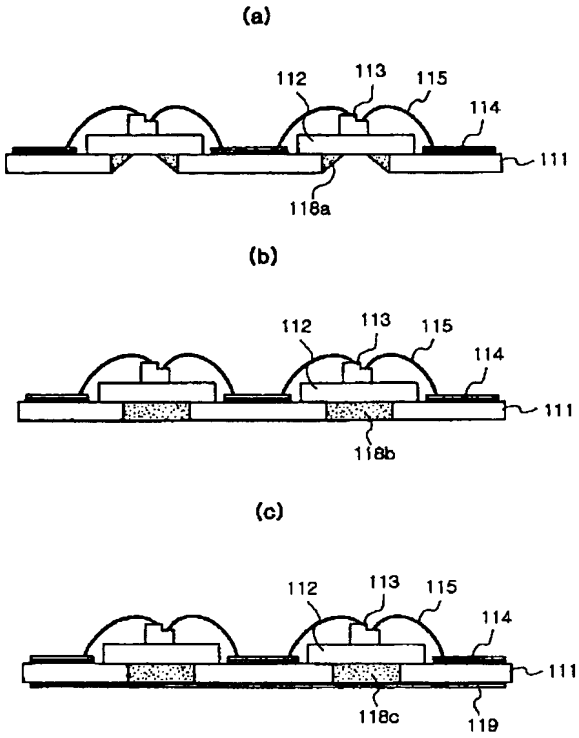
【図５】


(a)
123'
123
125
126
127
124
122'
121a'
122a'
122
122a
121a
121
(b)
133'
133
135
136
137
134
131a'
132
131a
131

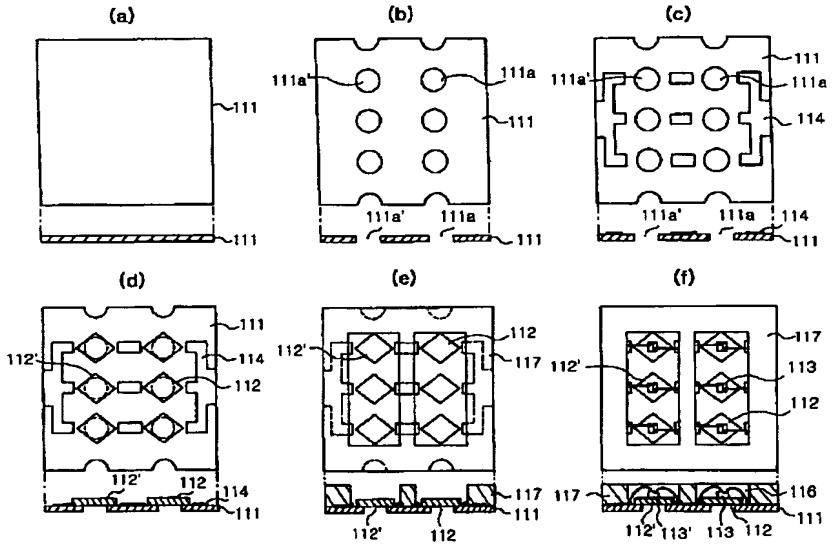
【図６】


(a)
143'
143
145
148
147
144
141a'
142a'
142
141a
142a
141
(b)
154'
153'
154a'
155'
154a
153
155
156
157
154
152'
151a'
152
151a
151

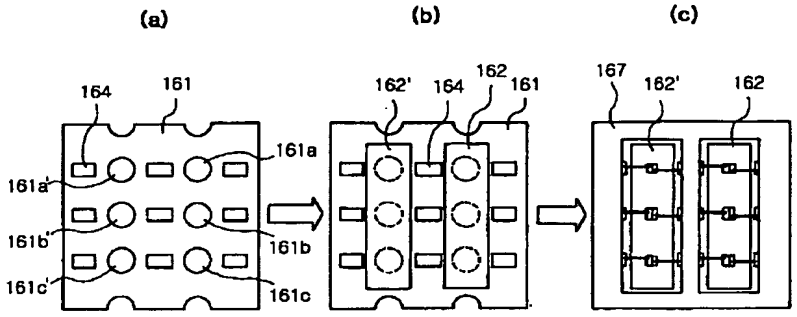
【図７】


(a)
112
113
115
114
111
118a
(b)
112
113
115
114
111
118b
(c)
112
113
115
114
111
118c
119

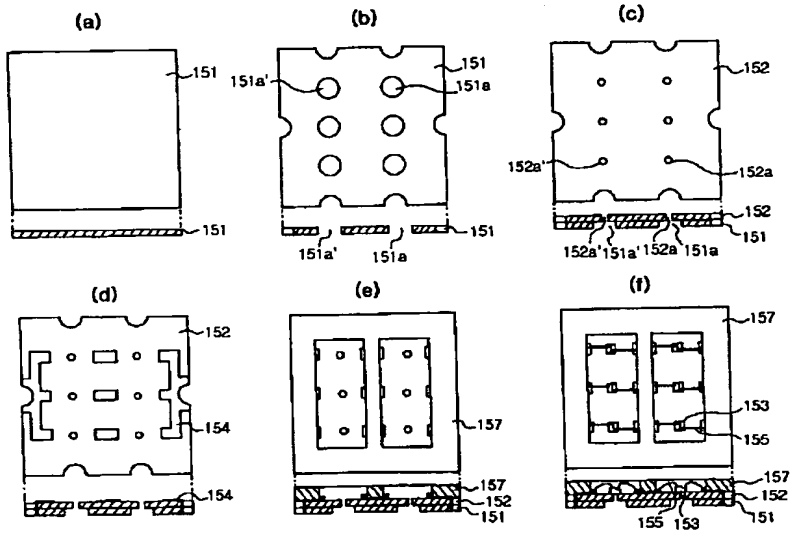
【図９】


(a)
111
111
(b)
111a'
111a
111
111a'
111a
111
(c)
111
111a'
111a
114
111a'
111a
114
111
(d)
111
112'
114
112
112'
112
114
111
(e)
112
112'
117
117
111
112'
112
(f)
117
112'
113
112
117
116
111
112'
113'
113
112

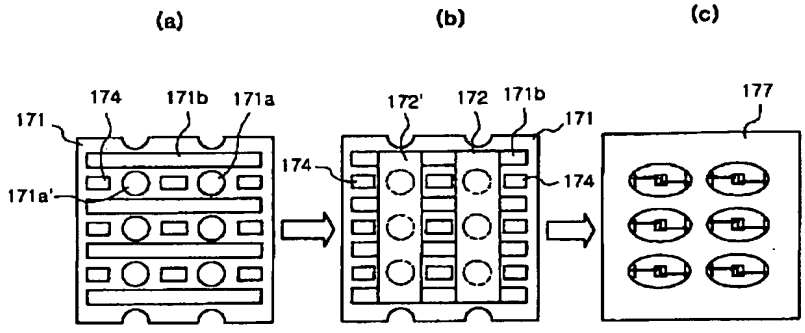
【図１０】



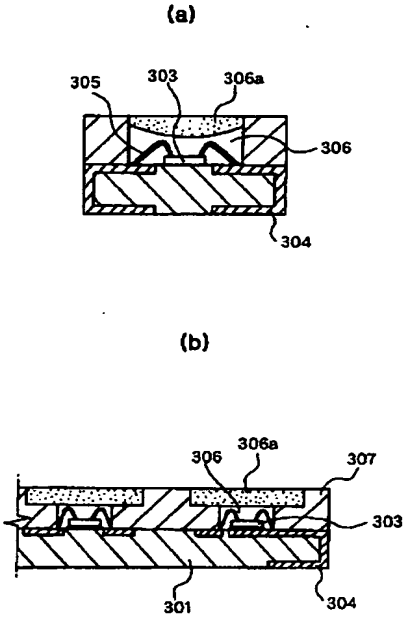
【図１１】



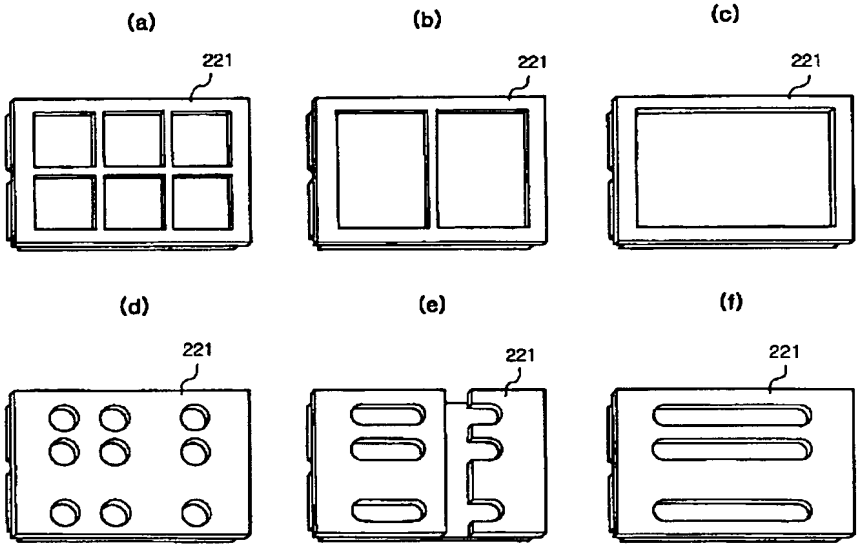
【図１２】



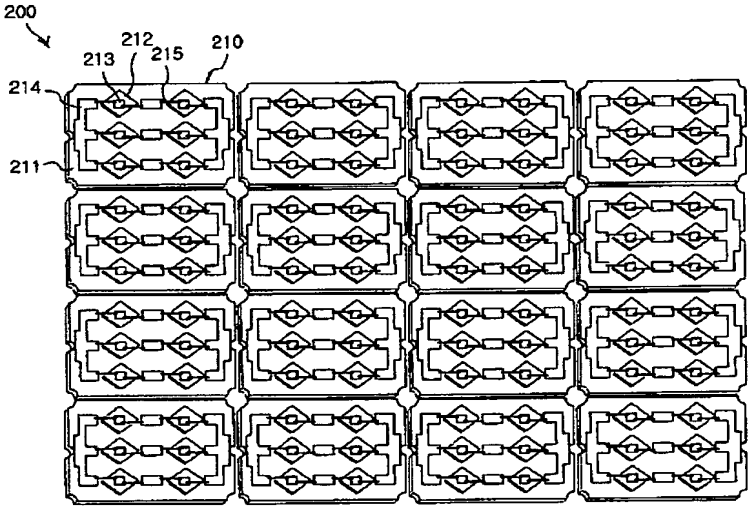
【図１５】



【図１３】



【図１４】



フロントページの続き

(72)発明者 李 彰 鎔
大韓民国京畿道城南市盆唐区亀尾洞鮮京アパート109洞2302号

Ｆターム(参考) 5F041 AA33 AA43 DA07 DA12 DA13 DA20 DB09 FF06 FF11